Bioresearches
A Babbage Company

77-109 Kapiti Road and 1 Brett Ambler Way, Paraparaumu

Assessment of Ecological Effects

for: New Central Park



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P.O. Box 2027, Auckland 1140. New Zealand

www.Bioresearches.co.nz

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Author(s)	Kate Feickert, M.Sc (Hons), MEIANZ, Senior Ecologist	Alisha Hart, M.Sc Terrestrial Ecologist
	Treffery Barnett, M.Sc (Hons), MEIANZ, CEnvP-Ecology Technical Director – Freshwater	Laura Dooley, M.Sc (Hons) MEIANZ Senior Aquatic Ecologist
	Michaela Scarrott, B.Sc, MEIANZ Terrestrial Ecologist	
Reviewer(s)	Treffery Barnett Technical Director – Freshwater	

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Cover Illustration: Wharemaukū Stream on the southern boundary of the site. (July 2023).

EXECUTIVE SUMMARY

New Central Park Limited propose to develop an approximately 36 ha located at 77-109 Kapiti Road and 1 Brett Ambler Way Paraparaumu, under a substantive Fast-track application. The site is located in a generally urban setting; however, the site itself is largely undeveloped, has been used for agricultural and horticultural purposes, and currently is primarily vegetated with pasture. The site is bordered by the Mackays to Peka Peka expressway, the Wharemaukū Stream, residential housing and commercial properties.

To inform this Ecological Impact assessment, the ecological values of the site were assessed for all terrestrial and freshwater components. The resulting values range between negligible and low for terrestrial habitats; moderate for avifauna; moderate for lizards; and negligible for bats. The ecological values of the freshwater habitats ranged from moderate (Wharemaukū Stream, five of the wetlands, and lower Watercourse 1), to low (the remaining four wetlands), to negligible (the drains, including much of Watercourse 1).

The site is bisected by a watercourse, a deep straight drain, which runs from the north to discharges into the Wharemaukū Stream in the south of site. Multiple smaller drains discharge into this watercourse. Nine natural inland wetlands, dominantly pastural wetlands, totalling 5.3 ha, were delineated on the site.

The proposed works will involve completion of bulk earthworks across the majority of the site; which will result in the permanent, complete loss of all existing freshwater, wetland and terrestrial habitat within most of the site boundaries.

It is proposed that the loss of stream and wetland habitat within the site is mitigated and offset with the ecological enhancement, realignment and naturalisation of the Wharemaukū Stream corridor, which would include the creation of up to 5.4 ha of wetland habitat. The wetlands would merge into a riparian buffer which would be planted with native, ecologically appropriate species which would in time grow to recreate naturally occurring habitats within the project area such as kahikatea-pukatea forest, mānuka fen and reedland habitats and wetland carr areas.

To appropriately mitigate for potential adverse effects on native fauna (birds, fish and lizards), the following measures are recommended: a site-specific Lizard Management Plan (LMP); a Native Freshwater Fauna Salvage and Relocation Plan (NFFSRP); and avifauna should be protected by avoiding vegetation clearance, or carrying out specific avifauna management, during the bird breeding season.

The magnitude of effect was measured against the value of the habitat, resulting in a very low to high range of the overall level of effect. However, after the effects management hierarchy has been fully implemented on each of the relevant species or habitats as recommended, the level of effect is mostly a net gain, therefore further mitigation measures are not required.

TABLE OF CONTENTS

Document Control and Revision Record i

Executive Summary ii

1 Introduction 9

1.1 Background 9

1.2 Overview of Proposed Works 10

2 Statutory Context 12

2.1 Fast-track Approvals Act 2024 (FTAA) 12

2.2 Resource Management Act 1991 (RMA) 12

2.3 Wildlife Act (1953) WA 12

2.4 National Environmental Standards for Freshwater (NES-F, 2020) 12

2.5 National Policy Statements 12

2.6 Regional and District plans and Policies 13

3 Assessment Approach and Methodology 14

3.1 EcIA Assessment 14

3.2 Zone of Influence 14

3.3 Desktop Review 14

3.4 Site Investigations 15

Artificial Cover Objects 16

4 Site Description 20

4.1 Ecological Context and Site History 20

4.2 Present-day Site Description 26

5 Ecological Value assessment 27

5.1 Terrestrial Habitats 27

5.2 Avifauna (manu) 31

5.3 Herpetofauna 36

5.4 Bats (pekapeka) 40

5.5 Freshwater Habitats 43

5.6 Ecological Value Summary 67

6 Assessment of Ecological Effects 68

6.1 Assessment Guidance 68

6.2 Proposed Works 68
6.3 Effects to Freshwater Habitats 69
6.4 Terrestrial habitats and fauna 77
6.5 Summary of effects 80

7 Summary and Recommendations 82
7.1 Management of protected native fauna 82
7.2 Ecological enhancement 83
7.3 Management of freshwater environments 84

References 85

Applicability and Limitations 87

List of Tables

Table 1. Native avifauna identified during the desktop study, corresponding conservation status (Robertson et al., 2021) and likelihood of presence within the site. 32
Table 2. Avifauna observed on-site and corresponding NZ conservation status (Robertson et al., 2021). 35
Table 3. Terrestrial herpetofauna of the Wellington region (mainland), corresponding Wellington mainland and NZ conservation statuses, and reported occurrence within 5 km of the site. 37
Table 4. Weather and survey data 39
Table 5. November 2024 bat survey data 41
Table 6. Weather data and valid nights during bat survey 42
Table 7. New Zealand freshwater fish database records for the Wharemaukū Stream catchment 44
Table 8. Freshwater fish species captured during overnight trapping or detected through eDNA. 47
Table 9. Vegetation plot results for the plot undertaken to confirm the extent of Wetland 7 61
Table 10. Habitat summary and ecological values of the wetlands present on site. 65
Table 11. Summary of ecological values of habitats and species within and surrounding the site. 67
Table 12. Magnitude of effect and level of effect of the proposed works to freshwater habitats WITHOUT effects management measures 71
Table 13. Magnitude of effect and level of effect of the proposed works to terrestrial habitats and fauna WITHOUT effects management measures 78
Table 14. Level of effect of the removal of vegetation and aquatic habitats on the relevant species groups or habitats described in Section 6. The level of effect is calculated using the matrix presented in Table 16 and Table 17. 80
Table 15. Criteria for assigning value to habitat/species for assessment. 90

Table 16. Criteria for describing the magnitude of effects (EIANZ 2018) 90

Table 17. Criteria for describing the level of effects (EIANZ 2018). Where text is italicised, it indicates 'significant effects' where mitigation is required. 91

Table 18. Not-threatened and non-resident avifauna species found within 5 km of the site 94

List of Photos

Photo 1. Example of exotic grassland habitat within the site 30

Photo 2. Example of exotic grassland habitat within the site 30

Photo 3. Closeup example of exotic scrubland habitat within the site 31

Photo 4. Overview photo showing the localised patches of exotic scrubland habitat within the site 31

Photo 5. Areas of potential lizard habitat on Site within dense rubbish piles and rank grassland. .. 39

Photo 6. Wharemaukū Stream, upstream of the confluence with Watercourse 1 51

Photo 7. Wharemaukū Stream, upstream of the confluence with Watercourse 1 51

Photo 8. Wharemaukū Stream, viewed looking downstream. The confluence with Watercourse 1 is visible in the foreground 51

Photo 9. The channel immediately downstream of the confluence with Watercourse 1. Here, the tannin stained water from Watercourse 1 can be seen mixing with the lighter-coloured water of the Wharemaukū Stream. 51

Photo 10. Watercourse 1 53

Photo 11. Watercourse 1 53

Photo 12. Watercourse 1 53

Photo 13. Drain 1 53

Photo 14. Drain 1 53

Photo 15. Drain 1 53

Photo 16. The upper portions of Drain 3 54

Photo 17. The upper portions of Drain 3 54

Photo 18. Drain 4 55

Photo 19. Location of Drain 4 under gorse and blackberry 55

Photo 20. Example of vegetation in Wetland 1 56

Photo 21. Example of vegetation in Wetland 1 56

Photo 22. Elevated view of Wetland 2, facing south. Also visible is Wetland 4 (far left) and Wetland 1 (beyond Wetland 2); as well as the Wharemaukū Stream (solid blue line, and Watercourse 1 (dashed blue line). 57

Photo 23. Example of vegetation in drier areas of Wetland 2 57

Photo 24. Example of vegetation in wetter areas of Wetland 2 57

Photo 25. Example of mosaic open water areas in Wetland 2 in May 2023. 57
Photo 26. Example of vegetation in Wetland 3 58
Photo 27. Example of vegetation in Wetland 3, also showing pockets of open water in May 2023. . 58
Photo 28. Elevated view over Wetland 3 58
Photo 29. Open water area within Wetland 4, May 2023 59
Photo 30. Overview of Wetland 4, showing the permanently saturated portion (May 2023). Wetland 2 and Watercourse 1 are also outlined 59
Photo 31. Example of vegetation in Wetland 4 59
Photo 32. Example of vegetation in Wetland 4 59
Photo 33. Example of vegetation in Wetland 5 60
Photo 34. Example of vegetation in Wetland 5 60
Photo 35. Example of vegetation in Wetland 5 60
Photo 36. Example of vegetation in Wetland 5 60
Photo 37. Example of vegetation in Wetland 6 61
Photo 38. Example of vegetation in Wetland 6 61
Photo 39. Wetland 7, photographed from the north, facing south 62
Photo 40. Example of vegetation in Wetland 7 62
Photo 41. Carex geminata swards within Wetland 7 62
Photo 42. Open water area within Wetland 7 62
Photo 43. Example of a deeper section of drain within Wetland 8 63
Photo 44. Example of a shallower section of drain within Wetland 8 63
Photo 45. Example of a deeper section of drain within Wetland 8 63
Photo 46. Example of a deeper section of drain within Wetland 8, which has been overgrown with Isolepis prolifera 63
Photo 47. Example of vegetation in Wetland 9 64
Photo 48. Wetland 9 view towards main site 64
Photo 49. Wetland 9 site cleared of vegetation June 22 64
Photo 50. Hardstand area on Wetland 9 site (Google Earth current default imagery). 64

List of Figures

Figure 1. General site layout 9
Figure 2. Proposed development layout 11
Figure 3. ACO (48) extent and distribution targeting areas of suitable lizard habitat on Site. 17
Figure 4. Map of ABM locations for bat survey, with wetlands and shelterbelts shown for context 18

Figure 5. Land Environments New Zealand 'Potential Vegetation of New Zealand' layer relative to the site. Image reproduced from Boffa Miskell (2022). 21

Figure 6. Historic aerial image from 1942 showing the Wharemaukū Stream (blue lines) and its natural reaches and headwaters (red circle) south of the site (yellow polygon) 22

Figure 7. Historic alignment of the watercourse (pink dash polygon) in 1942 within the site (yellow polygon) and east of the site, showings its unnatural form and lack of natural portions, including the headwaters. 23

Figure 8. The site in 1951. Imagery sourced from Retrolens. 23

Figure 9. Historic aerials of the site, from 1963 through to 2018. Sourced from both Retrolens and Google Earth. 25

Figure 10. Map of the site showing current day site conditions. Sourced from Nearmap 26

Figure 11. Protected habitats, identified (blue polygon - Andrews Pond Scientific Reserve) within the vicinity of the site 27

Figure 12. Terrestrial vegetation types identified within the site. 29



Figure 13. Location of two ponds to the north and south-east of the site, just outside the boundary. 34

Figure 14. Lizard records from the DOC Herpetofauna records (sourced September 2026) within 5km of the Site 38

Figure 15. Bat records within the vicinity of the site 41

Figure 16. GWRC 'Regional Highly Modified Streams' overlay relative to the site. Pink lines indicate highly modified streams whilst blue lines indicate natural watercourses. 44

Figure 17. Local NZFFDB brown mudfish records. Left is a map of showing the general location of records relative to the site, and the inset maps indicate the habitat types where the records are located. . 46

Figure 18. Site map with location of fish survey site and sites where eDNA samples were collected 47

Figure 19. Stream and wetland habitats within the site, and stream ecological valuation assessment areas. 49

Figure 20: Diagram showing in-stream enhancements proposed along the Wharemaukū Stream 75

Figure 21: Diagram showing softer planting on true left bank adjacent to roadside to allow for flood maintenance; and denser, woodier planting on the true right bank where flood maintenance access is not required 76

Figure 22: Along the True Left Bank, clusters of taller planting occur at approximately 45% density between areas of lower growing grasses to allow for flood maintenance activities. 76

List of Appendices

Appendices

Appendix 1– Ecological Impact Assessment Methodology

Appendix 2 – Plant Species from wetland plots by botanist Pat Enright (Boffa Miskel, 2020)

Appendix 3 – Not-threatened and non-resident avifauna records

Appendix 4– Stream Summary Data and Fish IBI Scores

Appendix 5 – Fish IBI Scores

Appendix 6. Classification of watercourses on site again assessment criteria.

Appendix 7– Wharemaukū Stream Enhancement Toolbox

1 INTRODUCTION

1.1 Background

New Central Park Limited engaged Bioresearches to complete an Assessment of Ecological Effects (AEcE) to support a Fast-track application for the proposed development of 77-109 Kapiti Road and 1 Brett Ambler Road, Paraparaumu (hereafter referred to as 'the Site') (Figure 1). The site is an approximately 36 ha site located in a generally urban setting; however, the site itself is largely undeveloped and has been used for agricultural and horticultural purposes for the last 100 plus years. Presently, one shed is present on the property, and it is primarily vegetated with pasture. A dune ridge is orientated from west to east across the site.

The site is bordered on its north-western boundary by the Mackays to Peka Peka expressway, and on the south-eastern and southern border by the Wharemaukū Stream. To the north, east and west of the site is residential housing and to the south and south-east is predominantly commercial.

Within the site is a watercourse which flows into the site in the northeast, and discharges into the Wharemaukū Stream near the western corner of the site. Multiple smaller drains discharge into this watercourse.

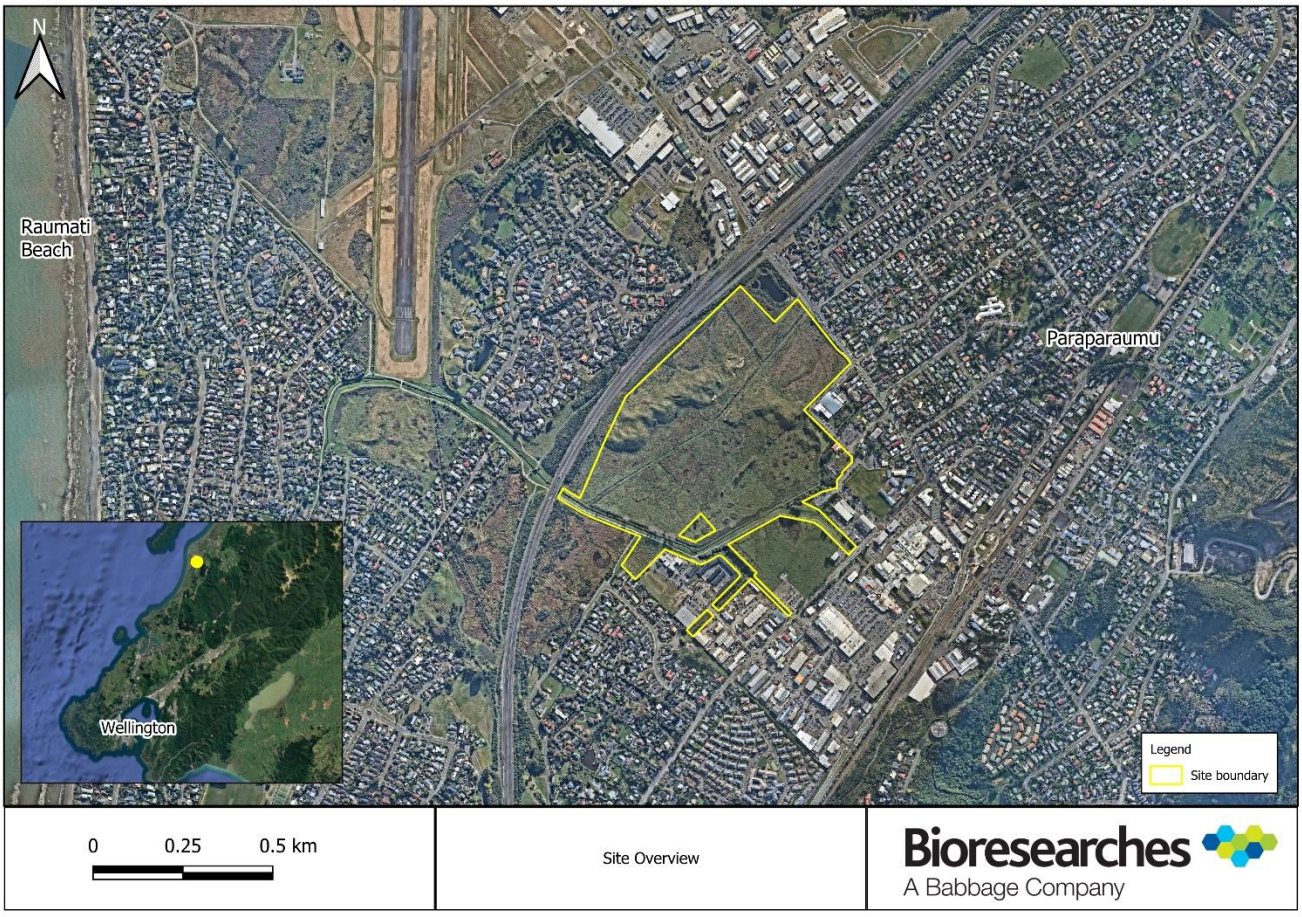


Figure 1. General site layout

Bioresearches have been involved in this development since the land was purchased by TWC in 2022. This has included undertaking detailed site assessments that culminated in the preparation of an Ecological Assessment to support the Kapiti Coast District Council (KCDC) and Greater Wellington Regional Council (GWRC)

consent applications. As a result, there is already a well-established and robust understanding of the ecological values present across the site. A significant body of ecological reporting has therefore already been completed, which provides a strong foundation for the current assessment.

Bioresearches have also been actively involved in the development and refinement of the current proposal, ensuring that ecological constraints and opportunities have been appropriately integrated into the masterplan. While the existing technical work remains highly relevant, it will be updated and refined as necessary to reflect the revised proposal and to ensure that the assessment accurately addresses the ecological effects of the project as now proposed.

The assessment work culminated into the completion of the following reports:

- Bioresearches (2023a) Memorandum: 77 Kapiti Road – Remediation. Memo to The Wellington Company. 19 November 2023. 1 pg.
- Bioresearches (2023b) Memorandum: Kapiti Development Proposed Wetland Hydrology. Memorandum to The Wellington Company. 14 December 2023 4pp.
- Bioresearches (2023b) 77-109 Kapiti Road, Paraparaumu Stream and Wetland Loss Offset Report December 2023. V3 dated 14 December 2023. 47 pp.
- Bioresearches (2024) Memorandum: 77 – 109 Kapiti Road, Paraparaumu S92 Response. Memorandum to The Wellington Company. 11 June 2024. 14 pp.
- Bioresearches (2025a) Memorandum: Bat Survey Dec 2024 – Jan 2025: 77 – 109 Kapiti Road, Paraparaumu. Memorandum to The Wellington Company. 15 April 2025. 6pp.
- Bioresearches (2025b) Memorandum: Lizard Survey April 2025: 77 – 109 Kapiti Road, Paraparaumu. Memorandum to The Wellington Company. 1 May 2025. 5pp.
- Bioresearches (2025c) 77-109 Kapiti Road, Paraparaumu Assessment of Ecological Effects. Report for The Wellington Company. Version 6 Dated 27 May 2025. 95pp.

This Ecological Affects Assessment is a culmination of all of the reports.

1.2 Overview of Proposed Works

The proposed development for the Project are shown in Figure 2. The Project comprises the comprehensive development of the site as an extension to the Paraparaumu town centre, including residential, large format retail, specialty retail, commercial and other associated activities, together with the construction of the internal road network, pedestrian and cycle connections, open space, landscaping, stormwater infrastructure and associated servicing.

Land use consent is sought for the proposed development as a whole, including the residential and commercial activities and buildings, rather than solely for enabling earthworks and infrastructure works to facilitate future development. The Project will also involve bulk earthworks across the site to establish the proposed development platforms, road network, open spaces and associated infrastructure.

The Wharemaukū Stream will be retained in its existing alignment along the southern part of the site and enhanced through naturalisation and riparian planting. The Project also includes the creation and enhancement of wetland habitat, together with associated flood storage and stormwater management areas within the western and southern parts of the site.

The proposed development, its potential ecological effects, and the measures proposed to avoid, minimise, remedy, offset and/or compensate for those effects are discussed in further detail in Section 6.2.



Figure 2. Proposed development layout

2 STATUTORY CONTEXT

This section summarises the legislation, policy, plans and strategies relevant to the protection, conservation and enhancement of nature conservation interests associated with the site. The ecological values described in this report allow significant ecological issues and adverse effects to be identified as they relate to planning, policy and statutory framework as addressed in the sections below.

2.1 Fast-track Approvals Act 2024 (FTAA)

The purpose of the FTAA is to facilitate the delivery of infrastructure and development projects with significant regional or national benefits. The system is intended to be a 'one-stop-shop' for resource consents under the Resource Management Act 1991 and includes approvals required (for this Project) under the Wildlife Act (1953).

2.2 Resource Management Act 1991 (RMA)

The purpose of the RMA is to achieve sustainable management of natural resources. Important elements of this are the maintenance of indigenous biodiversity and the protection of significant indigenous vegetation and habitats. The RMA requires that any adverse effects of development be avoided, remedied, or mitigated.

2.3 Wildlife Act (1953) WA

The WA provides legal protection to listed species classed as wildlife. It controls how people interact with wildlife, including all native birds, bats, frogs, lizards, and some invertebrates. Note, it does not cover plants or freshwater fish. A recent Amendment Bill has key provisions that aim to balance the practicalities or lawful activities that may incidentally harm or kill wildlife. It should be noted, there-fore, that the amendments enable the Department of Conservation to impose conditions on authorisations to mitigate adverse effects of wildlife, if the overall effect of granting the authority will be protective of wildlife.

2.4 National Environmental Standards for Freshwater (NES-F, 2020)

The National Environmental Standards for Freshwater 2020 (NES-F) set requirements and regulations for carrying out certain activities that pose risks to freshwater and freshwater ecosystems. Loss of wetland extent is a Discretionary Activity under Subpart 45C of the NES-F ('Urban Development), provided that the urban development will contribute to a well-functioning urban environment; there no practicable alternative to the location of the activity impacting wetlands, or alternative locations will result in a greater adverse effect; and the effects management hierarchy is applied.

2.5 National Policy Statements

2.5.1 National Policy Statement for Freshwater Management (NPS-FM, 2020)

The NPS-FM provides direction under the RMA to local authorities for managing activities that affect the health of freshwater ecosystems. It establishes protections for freshwater bodies, including natural inland wetlands, and includes provisions for monitoring and reporting on freshwater quality and quantity. The NPS-FM also addresses the impacts of land use activities on freshwater resources, ensuring that these are sustainably managed.

The effects management hierarchy is an approach to managing the adverse effects of an activity on wetlands that requires that (NPS-FM, 3.21):

a) adverse effects are avoided where practicable; then
b) where adverse effects cannot be avoided, they are minimised where practicable; then
c) where adverse effects cannot be minimised, they are remedied where practicable; then
d) where more than minor residual adverse effects cannot be avoided, minimised, or remedied, biodiversity offsetting is provided where possible; then
e) where biodiversity offsetting of more than minor residual adverse effects is not possible, biodiversity compensation is provided; then

- if biodiversity compensation is not appropriate, the activity itself is avoided.

2.5.2 National Policy Statement for Indigenous Biodiversity (NPS-IB, 2023)

The National Policy Statement for Indigenous Biodiversity 2023 (NPS-IB) provides direction to councils to protect, maintain and restore indigenous biodiversity in the terrestrial environment, requiring at least no further reduction of significant indigenous terrestrial biodiversity nationally.

The NPS-IB provides protection to significant terrestrial vegetation and habitats, with a focus on tangata whenua as kaitiaki of species and ecosystems which are taonga to them (NPS-IB, Policy 2). At the time of preparation of this report, no acknowledged terrestrial taonga species have been identified in the public domain.

The terrestrial vegetation within the site is almost exclusively pasture; the site is not an area that is notified in the district plan as an SNA or already identified in a policy statement or plan as an area of significant indigenous vegetation; and the development will not result in significant adverse effects on indigenous biodiversity outside of the site; therefore the Project would not be inconsistent with the Policies and Objectives of the NPS-IB (NPS-IB Policies 7, 8).

2.6 Regional and District plans and Policies

The Greater Wellington Regional Plans (including the Regional Freshwater Plan, Regional Soil Plan, and proposed Natural Resources Plan) and the Kapiti District Plan are the principal statutory planning documents which cover the site. These plans are prepared by Greater Wellington Regional Council (GWRC) and Kapiti District Council (KDC) for the purpose of giving effect to the RMA as a regional council and/or a territorial authority.

3 ASSESSMENT APPROACH AND METHODOLOGY

3.1 Ecological Effects Assessment

This effects assessment generally follows the Ecological Impact Assessment (EcIA) Guidelines for use in New Zealand published by the Environmental Institute of Australia and New Zealand (EIANZ) (Roper-Lindsay et al., 2018). The EcIA Guidelines provide a standardised matrix framework that allows ecological effects assessments to be clear, transparent, and consistent. The EcIAG framework is generally used in Ecological Impact Assessments in New Zealand as good practice, and a detailed analysis of this methodology is presented in Appendix 1.

3.2 Zone of Influence

The zone of influence (ZOI) of the Project relates to an area occupied by habitats and species that are adjacent to and may extend beyond the boundary of the Site. It is defined in the EIANZ Guidelines as "the areas/resources that may be affected by the biophysical changes caused by the proposed Project and associated activities."

The ZOI of the Project on different species differs depending on how the species uses their environment. For example, mobile species such as birds and long-tailed bats have large home ranges across more diverse habitats compared to lizards and threatened plant species which may be restricted to a small area or specific habitat type. This affects how a species could be impacted by the Project and was taken into consideration during the desktop review and site investigations. To reflect the likelihood of a species occurring or its potential dispersal ability, varying search distances were used depending on the species context.

3.3 Desktop Review

A desktop review of various online GIS databases was undertaken to determine the extent of ecological protection overlays (e.g., covenants, conservation land, SNAs), 'ecosystem type' classifications, and visualise historical land-use using historical aerial images. The scheduling of SNAs and classification of ecosystems provides a means for Councils to protect and maintain indigenous biodiversity within Districts and Regions. The desktop review also included a search for fauna records from various information sources.

Specifically, the following databases were reviewed:

- Department of Conservation BIOweb records for lizards and bats[1];
- iNaturalist records within approximately a 5 km radius from the Site[2];
- New Zealand Bird Atlas eBird database[3]. Bird data is recorded in 10 km^2 grid squares. Grid square BU68 was accessed as this is positioned over the Site;
- NIWA's New Zealand Freshwater Fish Database[4] records were accessed for affected stream catchments;
- Wilderland eDNA explore database;
- Greater Wellington Regional Council and Kapiti District Council GIS maps;

[1] https://www.doc.govt.nz/our-work/monitoring-reporting/request-monitoring-data/
[2] https://inaturalist.nz/home
[3] https://ebird.org/home
[4] https://nzffdms.niwa.co.nz/

- Department of Conservation Threat Classification Series[5];
- Retrolens historic aerial imagery[6]; and
- A classification of New Zealand's terrestrial ecosystems (Singers & Rogers, 2014)[7].

Two previous ecological reports were available which had been completed for the site (Boffa Miskell 2020, 2022), and a report by GWRC on a natural wetland investigation of the site (GWRC, 2023). These reports were all reviewed.

In addition, the Kaitiakitanga Plan for Te Ātiawa Ki Whakarongotai, Ātiawa Ki Whakarongotai Whakarongotai te moana Whakarongotai o te wa, was read and acknowledged prior to the field investigations.

3.4 Site Investigations

Site investigations have been undertaken over multiple periods between 2023 and 2026 (2nd and 3rd May, 24th to 26th July, and 23 September 2023; 7th and 8th May, 21st November and 3 December 2024; 19th January, 26th March, 28th April to 1st May 2025; and the 17th March 2026) to gather additional information on terrestrial and freshwater habitats and native fauna presence within the Site. Targeted species surveys were also undertaken, the timing of which, and methodologies listed for each habitat type and species are listed below.

3.4.1 Vegetation

The vegetation within the site was assessed using a 'walk through' methodology. Botanic values recorded included native and exotic vascular vegetation, and notes were made on the quality and extent of vegetation present on site. No specific surveys for native plants were undertaken.

3.4.2 Lizard survey

The Site was surveyed for the presence of lizards using three methodologies:

1. *Onduline* artificial cover objects (ACOs),
2. Diurnal visual encounter surveys (VES), and
3. Hand-searching organic and inorganic matter where possible.

These methods are considered standard and reliable techniques for detecting reptiles in New Zealand (Lettink & Hare, 2016; Whitaker, 1994) and are discussed in further detail below.

As optimal conditions vary between species, ACO checks and VES were performed under a variety of conditions and temporal periods; however; ACOs were not checked during periods of temperature extremes (<5°C and >-25°C, heavy precipitation) as ACO detection efficacy and lizard activity is reduced within these conditions.

Lizard surveys were undertaken on the Site under Wildlife Authority 37605-FAU, 98006-FAU.

[5] All Department of Conservation Threat Classification Documents are listed in the below webpage. When individual reports are referenced hereafter, they are referenced in-text.
https://www.doc.govt.nz/aboutus/science-publications/conservation-publications/nz-threat-classification-system/
[6] https://retrolens.co.nz/
[7] https://www.doc.govt.nz/globalassets/documents/science-and-technical/sfc325entire.pdf

Artificial Cover Objects

Artificial cover objects (ACOs) were used as the primary method for detecting terrestrial lizards for this survey, as they are considered a best practice tool for detecting and monitoring native lizards in New Zealand (Lettink & Hare, 2016). The ACOs used were single layered, 400 mm x 475 mm corrugated *Onduline* sheets. *Onduline* is a bituminous corrugated roofing material that has heat-retention properties, providing refuge and thermoregulatory benefits for lizards.

A total of 48 ACOs were installed on the 26th March 2025 within areas identified as suitable lizard habitat such as within and adjacent to patches of scrub, piles of organic and inorganic matter, pampas bushes, areas elevated above wetland depressions and around the historic lizard record in the northern corner of the site (Figure 3). The ACOs were left undisturbed to settle into the environment for approximately four weeks[8] and were then inspected for lizards on four sequential days between the 28th of April and 1st of May 2025. ACO inspections were undertaken on days with environmental conditions deemed suitable for lizard activity (i.e., warm, calm, and precipitation-free days).

Visual encounter searches and hand searching

Visual encounter searches (VES) are active searches for either mobile (e.g., active sun-basking) or sedentary (e.g., refuging) lizards. This technique is a proven and standard technique employed for detecting lizards in New Zealand (Whitaker, 1994; Lettink and Hare, 2016).

Diurnal VESs were undertaken concurrently with ACO installation on 26th March and repeated during each of the four ACO inspections during March - April 2025. Searches involved scanning for basking lizards among vegetation, vegetation edges, and on other habitat features (e.g., log piles) and actively searching for refuging lizards by lifting debris (e.g., logs, rocks, and organic and inorganic material).

[8] This settling period allows time for the covers to take on the scent of the surrounding environment and for lizards to find and begin using them.



Figure 3. ACO (48) extent and distribution targeting areas of suitable lizard habitat on Site.

3.4.3 Bats

Department of Conservation AR4s (Department of Conservation electronics team, Wellington, New Zealand) were used throughout the survey period to record activity. These units have a 30-60 m range (Department of Conservation, 2024) depending on environmental clutter and conditions. They were set to record from at least 1 hour before official sunset to at least 1 hour past official sunrise.

The five Automatic Bat Monitors (ABMs) were deployed from 3rd December 2024, and left until the unit batteries went flat (30/12/24-19/01/25) to provide a longer survey period than the standard two weeks, targeting habitat within/ adjacent to the site that was most likely to be used by bats for commuting, foraging, or roosting (Figure 4). Namely:

- ABM 1: Stormwater retention pond – potential foraging
- ABM 2: Standing shed – potential roosting
- ABM 3: Wetland area with standing water – potential foraging
- ABM 4: Shelterbelt – potential commuting/ roosting
- ABM 5: Shelterbelt and stream – potential commuting, roosting, and foraging

Spectrograms were pre-processed using AviaNZ software (avianz.net, Wellington, New Zealand), and then individually visually assessed using BatSearch 3.23 (Department of Conservation, Wellington, New Zealand). Although lesser short-tailed bats were not considered to have suitable habitat within the site, they were still considered during spectrogram validation.

Weather data for air temperature, wind speed, and rainfall were obtained from nearby weather stations and checked against DOC guidelines to determine the number of valid survey nights (Department of Conservation, 2024). Nights were excluded when the air temperature dropped below 8°C within the first four hours after official sunset. While DOC guidance is subjective for rainfall and wind speed thresholds, nights were excluded where rainfall within the first four hours after official sunset exceeded 5 mm, or where average wind speed exceeded 18 km/hr. However, data from invalid survey nights were still assessed.

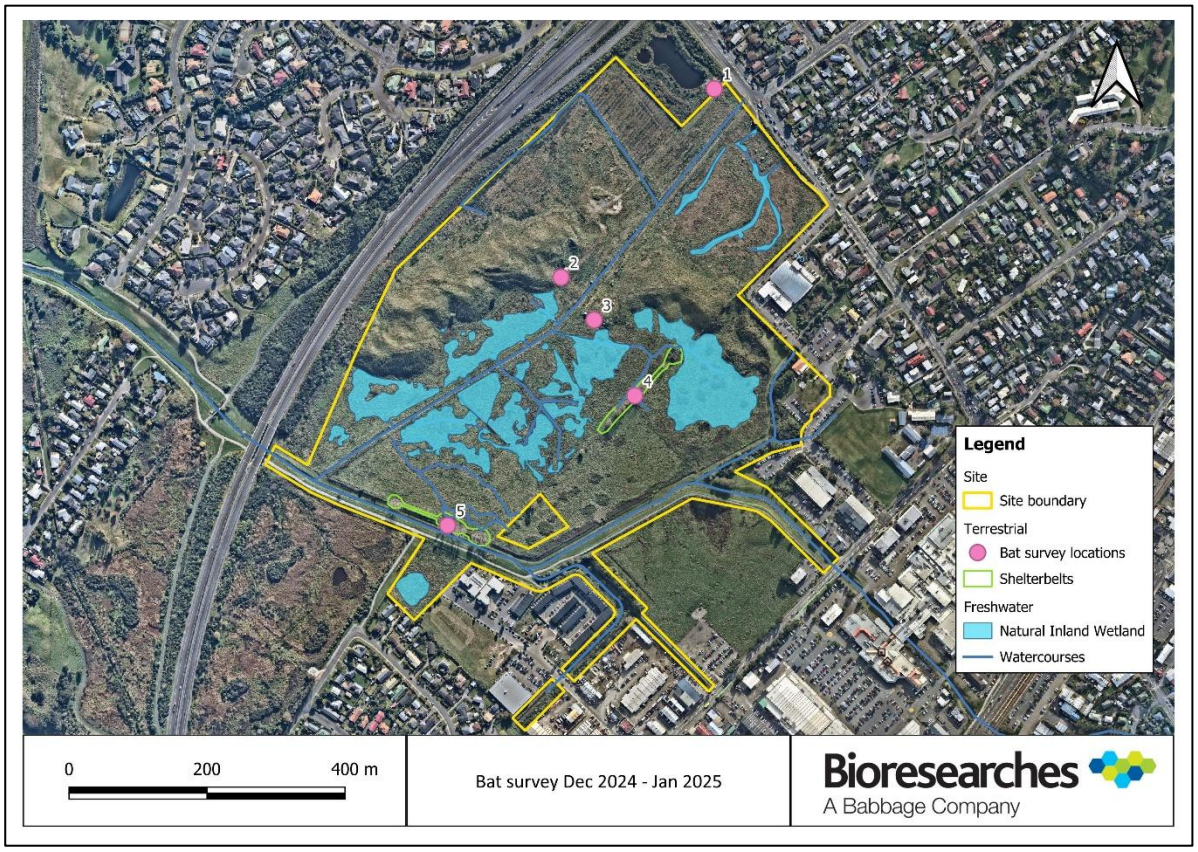


Figure 4. Map of ABM locations for bat survey, with wetlands and shelterbelts shown for context

3.4.4 Avifauna

Three five-minute bird counts (5MBC) were undertaken, and any opportunistic observations were recorded.

3.4.5 Freshwater habitats

During the site assessment, the presence and extent of wetlands, streams and other freshwater habitats within the Site were noted and the quality of any freshwater habitat was visually assessed; as described below in Sections 3.4.5.1 and 3.4.5.2.

3.4.5.1 Streams

Overland flow paths were ground-truthed and classified as to their permanent, intermittent or ephemeral status in accordance with GWRC 2021 Guidance[9]. In addition, these watercourses were assessed as to whether they were natural or artificial, using information from both the desktop review and site visit.

[9] Greater Wellington Regional Council (2021) Guidance Note: How to determine whether a watercourse is a river, ephemeral watercourse, highly modified river or stream, or artificial watercourse. May 2021.

An ecological value was then assigned to each stream, based upon factors such as:

- The intactness of the riparian zone;
- Permanency of flow and complexity of habitat present within the stream;
- Observable water quality parameters; and
- Modifications to hydrology and catchment of the stream.

During the July 2023 site visits, detailed assessments of representative reaches of the streams were undertaken using the Stream Ecological Valuation (SEV) methodology.

The SEV methodology (Storey et al., 2011; Neal et al., 2016) enables the overall function of the stream to be assessed and compared to the quality of other streams in the Greater Wellington Region. The SEV procedure involves the collection of habitat data (e.g. stream depth, substrate type, riparian cover), and sampling of fish communities and macroinvertebrates (e.g. insect larvae, snails), the latter being recognised indicators of habitat quality. SEV data are then entered into a SEV calculator to calculate a SEV value.

The SEV assessments were undertaken over two 100m sections of the Wharemaukū Stream and a 100m reach of the main drain flowing from north to south through the site (Watercourse 1). Each SEV reach was marked at the upstream and downstream boundaries with a handheld GPS. Photographs were taken and notes made on any evident habitat limiting factors, such as barriers to fish passage, or permanence of flows.

3.4.5.2 Wetlands

Potential wetland areas were assessed following the MfE wetland delineation protocols (MfE, 2020), including vegetation assessments and wetland hydrology to determine whether the areas meet the definition of a 'natural inland wetland' under the NPS-FM.

Vegetation was assessed based on the occurrence of:

- Obligate wetland vegetation (OBL) – almost always a hydrophyte, rarely in uplands;
- Facultative wetland (FACW) – usually a hydrophyte but occasionally found in uplands;
- Facultative (FAC) – commonly occurs as either a hydrophyte or non-hydrophyte;
- Facultative upland (FACU) – occasionally a hydrophyte by usually occurs in uplands; and
- Upland (UPL) – rarely a hydrophyte, almost always in uplands.

If wetlands were obviously dominated by OBL and/or FACW species, the 'rapid test' was used to classify the wetland as a natural inland wetland. If the rapid test was not able to be used, a vegetation plot was utilised and the dominance and/or prevalence tests applied to the plot results, to assess if the area was wetland or non-wetland habitat, in accordance with the methodologies listed in Clarkson, 2014. If results from these tests were unclear, hydric soils and hydrology tests were undertaken in accordance with the associated protocols (Fraser *et al*. (2018) and MfE (2021b)).

4 SITE DESCRIPTION

4.1 Ecological Context and Site History

The Site is located within the Foxton Ecological District (McEwen, 1987). The district contains the largest sand dune system in New Zealand, which largely defines the ecological district and its vegetation. The dune system was historically associated with dune lakes, wetland systems, lagoons and estuaries, however many of these have been drained, with only approximately 1.5% of the original extent of freshwater wetlands remaining (Ravine, 1992).

The site is situated upon two major soil types: the flat, lower lying areas are comprised of poorly drained, loamy peat over sand; whilst the raised dunes which bisect the site are comprised of well drained, loam over sand[10].

The Land Environments New Zealand 'Potential Vegetation of New Zealand' layer (Figure 5), which predicts historic vegetation composition, indicates that the dune system would historically been vegetated with Tōtara, matai, broadleaved dune forest (WF6). Young versions of this forest type contain mosaics of kānuka, red māpou, korokia and akeake whilst older forests contain ngaio, tītoki, kōwhai, tōtara, mataī, rewarewa, maire species, māhoe, lancewood and kaikōmako (Singers & Rogers, 2014).

Lower-lying portions of the site would have been vegetated with kahikatea, pukatea forest (WF8). These forests are generally dominated by kahikatea, with pukatea, swamp maire, rimu, tawa, kiekie and supplejack also present (Singers & Rogers, 2014). Fens likely formed in the wetter areas with lower nutrient inputs, which would have been vegetated with mānuka associations (Boffa Miskell, 2022); grading into wetland carr[11] type habitats including tī kōuka, toe toe, flax and cabbage trees, particularly in wetter areas or near open water (Ravine, 1992).

[10] Soil information from S-Map online; https://smap.landcareresearch.co.nz/maps-and-tools/app/

[11] 'carr' is a term used to describe wetlans which contain woody vegetation, and most often occur as a mid-successional stage between a herbaceous-dominated wetland and wetland forest.

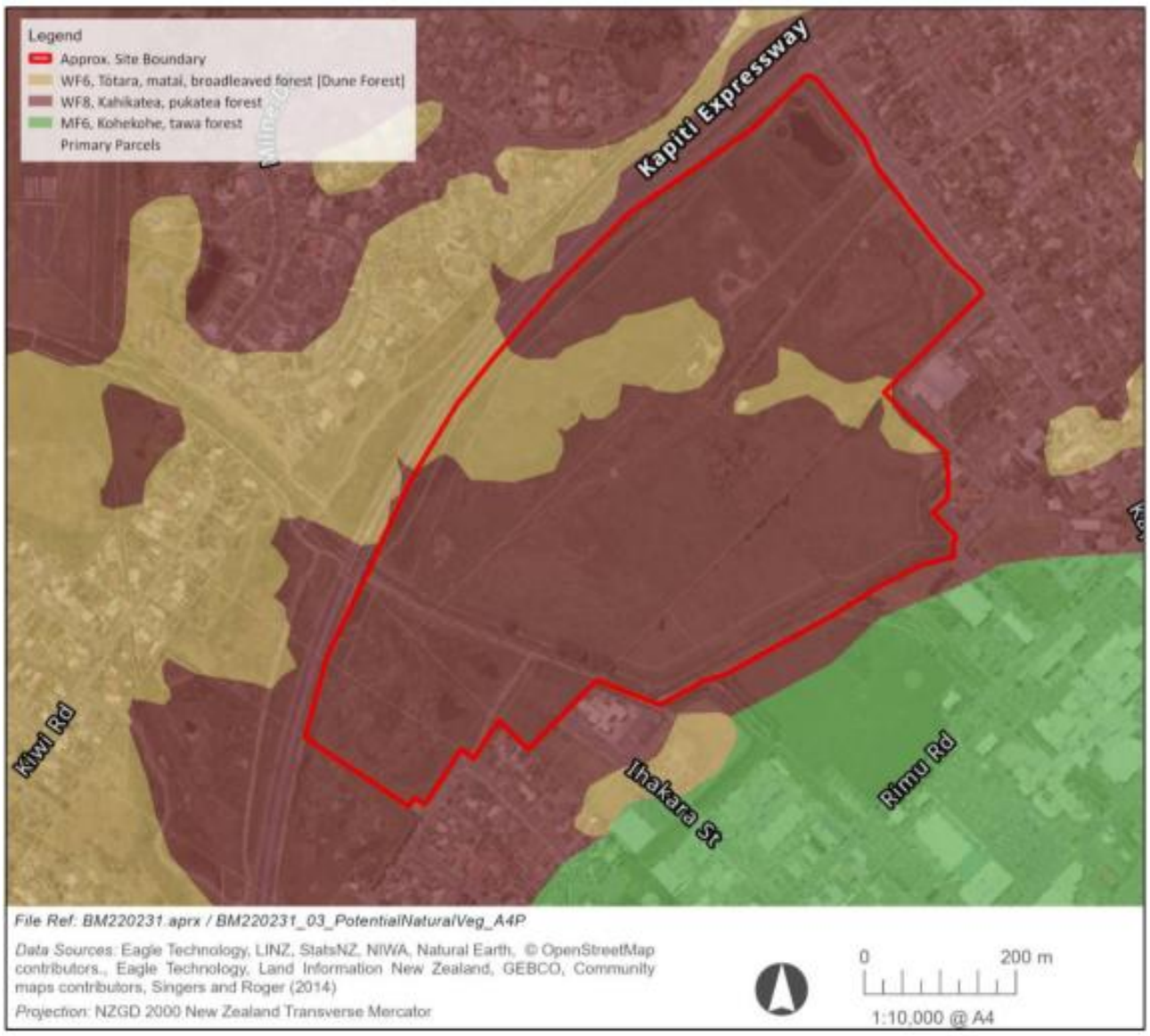


Figure 5. Land Environments New Zealand 'Potential Vegetation of New Zealand' layer relative to the site. Image reproduced from Boffa Miskell (2022).

The site has been cleared of all mature indigenous forest since at least 1951 (Figure 8), which is the earliest available historic imagery of the site. At that time, all portions of the site south of the dune system, including the dunes themselves, were vegetated with pasture species and appear to be actively grazed, whilst the portion of the site north of the dune system is vegetated with scrub, which appears to be a mānuka-dominated wetland system, such as a bog or fen.

The Wharemaukū Stream, which follows the site's south-eastern and southern boundaries, had already been straightened and realigned to follow its present-day channel. Natural headwaters and stream reaches are observable on historic aerial images from 1942, approximately 200 m south of the site, in which the lower reaches have been diverted, straightened and likely deepened to facilitate farm drainage (Figure 6). A watercourse was present within the site, inflowing on the site's northern boundary, and flowing through the site in a south-western direction, and discharging into the Wharemaukū Stream near the site's southern boundary. At least two smaller drains were visible which flowed into the watercourse. This watercourse is present in aerial images prior to 1942, approximately 2 km long, in which the entirety of the channel is straightened

with unnatural angled bends and no visible variation in bank width or formation, indicating it was likely dug out to drain the surrounding landscape to the north to facilitate farming activities (Figure 7).

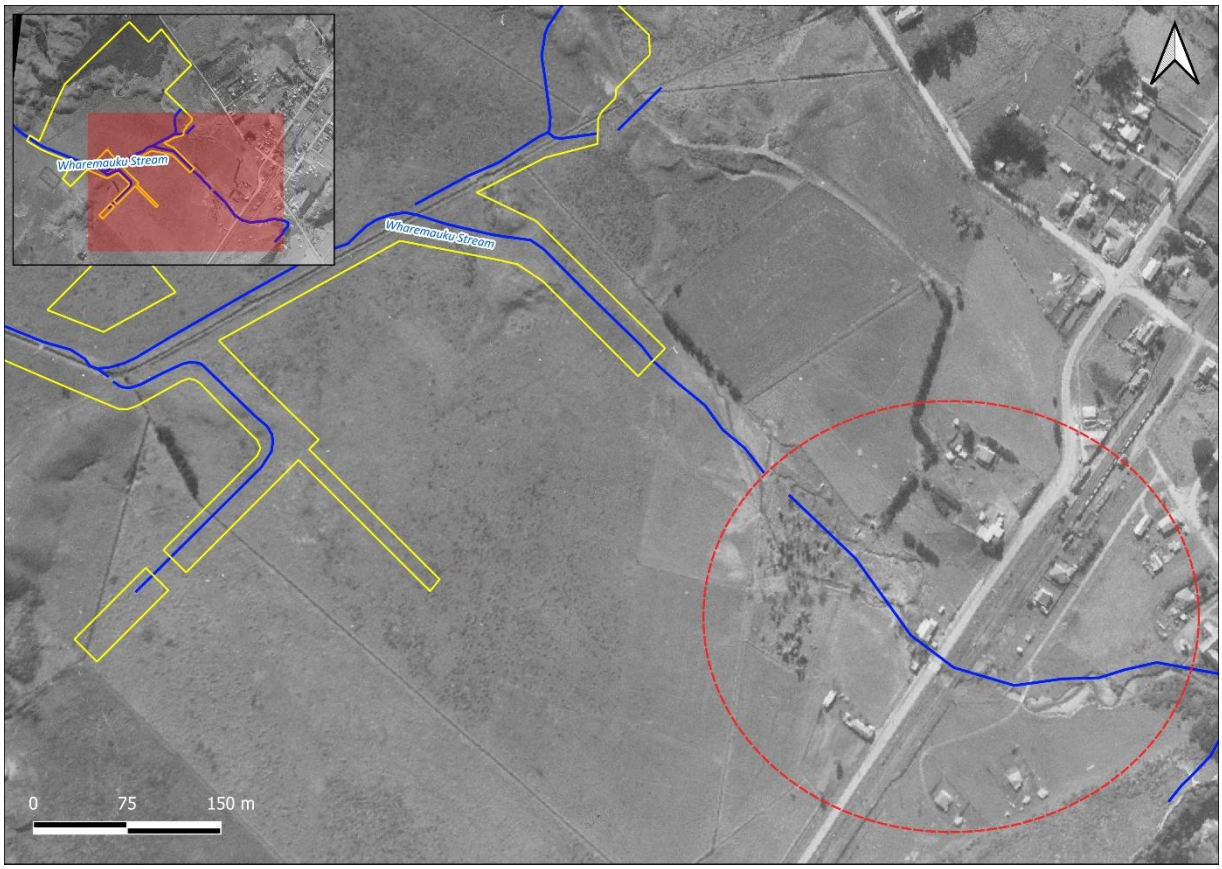


Figure 6. Historic aerial image from 1942 showing the Wharemaukū Stream (blue lines) and its natural reaches and headwaters (red circle) south of the site (yellow polygon)



Figure 7. Historic alignment of the watercourse (pink dash polygon) in 1942 within the site (yellow polygon) and east of the site, showings its unnatural form and lack of natural portions, including the headwaters.

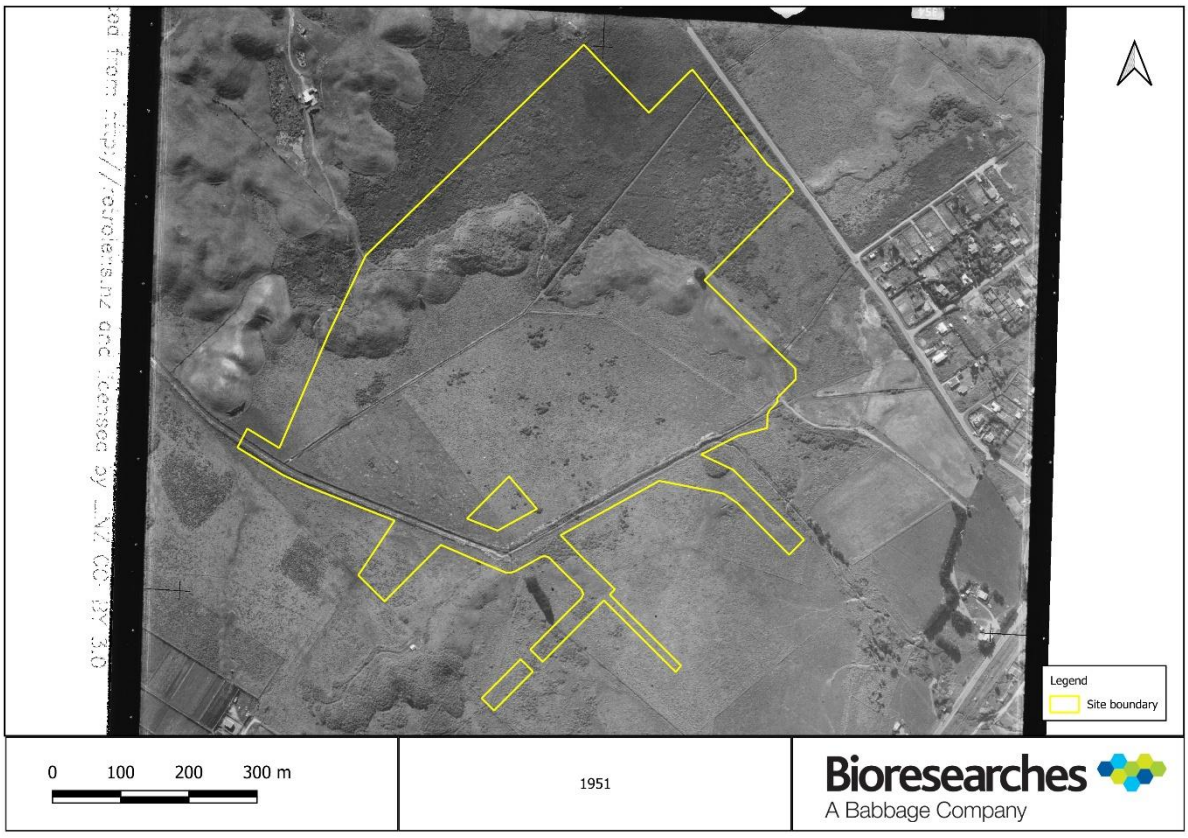


Figure 8. The site in 1951. Imagery sourced from Retrolens.

There was little change to the site between 1951 and 1973 (Figure 9). By 1986, a dwelling, shed and associated accessway had been constructed in the central portion of the site. By 1998, much of the northern half of the site had been cleared of woody vegetation and replaced with grassland, however the north-east corner of the site still supported shrubby, wetland-like vegetation. A grove of trees had been established south of the dwelling. Additional drains, outflowing into the central watercourse which flows through the site were being established.

By 2005, there was little change in the site, however more trees were established on the northern side of the accessway. Drains continued to be established throughout the site to direct water into the central watercourse. The site appeared to be less 'well kept' since 1998, with scrubby vegetation (likely to be gorse and/or blackberry) establishing in some of the paddocks.

By 2010, limited change was seen across the site. A second accessway had been established from the site's northern boundary; and scrubby vegetation was continuing to establish in the paddocks, which was continuing to occur by 2016. At this time, construction of the MacKays to Peka Peka Expressway had begun on the site's north-western boundary, which included a constructed stormwater treatment pond immediately north of the site. The wetland-like mānuka scrub vegetation in the site's north-eastern corner was still present, and a laydown area was established in the site's northern portion.

By late 2018, expressway construction had completed, and the site had again been cleared of much of the woody vegetation, including the scrub which had established in the site's northern corner, the trees to the north of the driveway and south of the dwelling, and all woody vegetation from the wetland-like area in the site's north-eastern corner.

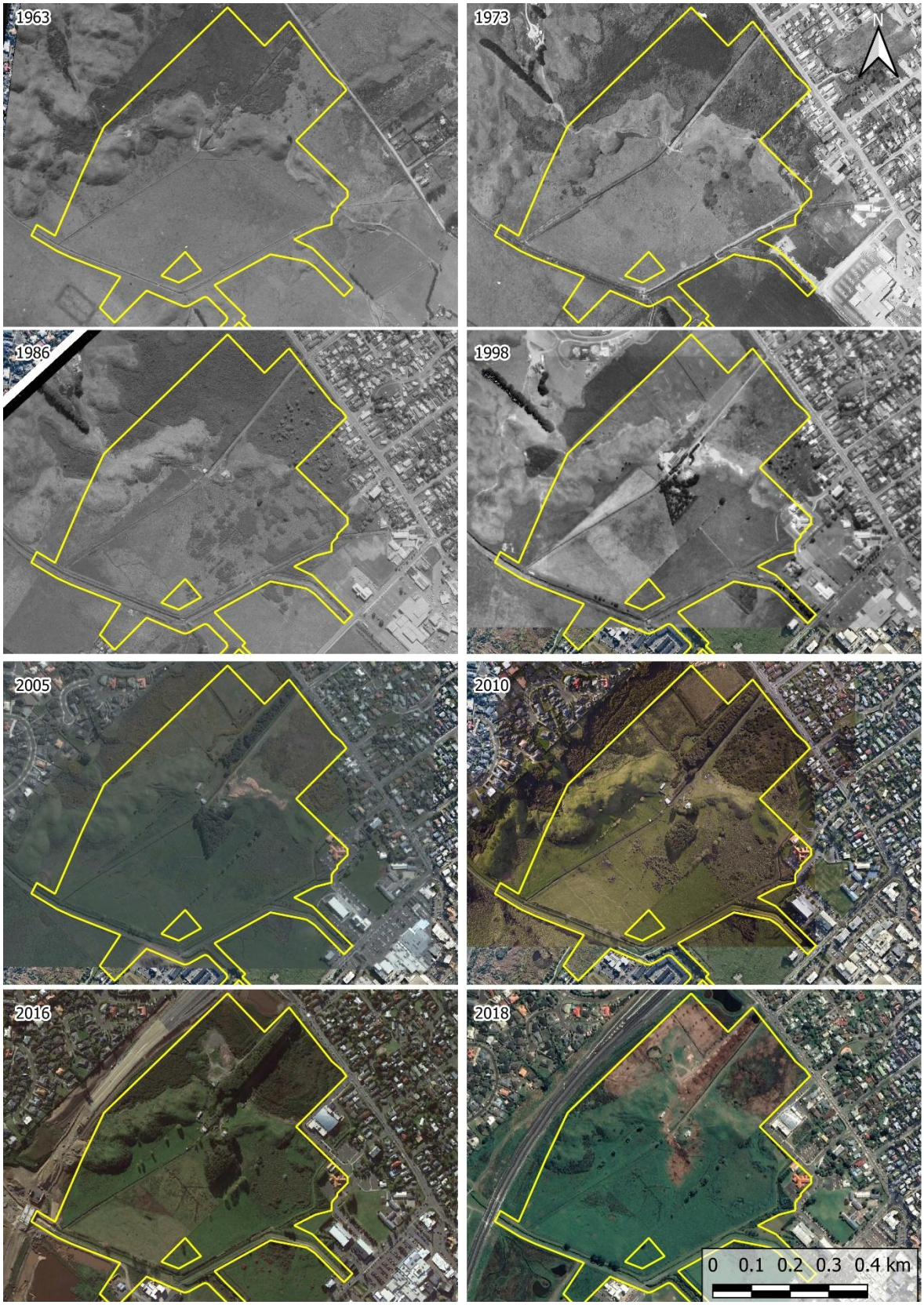


Figure 9. Historic aerials of the site, from 1963 through to 2018. Sourced from both Retrolens and Google Earth.

4.2 Present-day Site Description

In the present-day, the site is mostly vegetated with weedy pasture, with localised areas of scrubby vegetation present in aerial imagery across much of the site, particularly in the southern half. Multiple drains are present, feeding into the central watercourse drain which flows in a south-western direction through the site. The central watercourse pre-dates aerial imagery, however review of its alignment and morphology on aerial images in 1942 show it is a straightened and deepened drainage channel, wholly artificial with man-made cuts to the dune faces in this location (Figure 7). The dwelling on the property has been removed, however a shed and the accessways to the site from Kapiti Road remain.



Figure 10. Map of the site showing current day site conditions. Sourced from Nearmap

5 ECOLOGICAL VALUE ASSESSMENT

5.1 Terrestrial Habitats

The vegetation assessment involved both a desktop exercise and field visits to broadly determine the diversity of plant species present on-site and establish the value of the vegetation in the context of the surrounding landscape.

5.1.1 Desktop Assessment

One DOC scientific reserve, which is also listed as a Protected Natural Area, was identified northeast of the site, Andrews Pond Scientific Reserve (Figure 11). This was described by Ravine (1992) as a small dune lake, surrounded by wetland vegetation. It was considered the best example of a mānuka-sphagnum bog within the Kapiti District until it was partially reclaimed, and the adjacent subdivision was allowed to raise the water level, which killed the manuka and sphagnum (Kapiti Coast District Council, 2010). The wetland habitats which surrounded this area are likely similar to the wetland habitat which was present within the northern portion of the site from 1951 until at least 1986.

No other legal vegetation protections (e.g., QEII National Trust, Nature Heritage Fund Covenants, Regional or District Council overlays, or Nga Whenua Rahu) were identified on or in the vicinity of the site.

The plant species list from a 2020 site survey by Pat Enright has been included as Appendix 2.



Figure 11. Protected habitats, identified (blue polygon - Andrews Pond Scientific Reserve) within the vicinity of the site

5.1.2 Vegetation Descriptions

Terrestrial vegetation units identified onsite can be categorised into two categories:

- Exotic grassland; and
- Exotic shrubland, dominated by either gorse (*Ulex europaeus*) and/or blackberry (*Rubus fruticosus*).

Each of these vegetation types is identified below within Figure 12, and described in additional detail below. Localised exotic trees were also present throughout the site, and one mature tī kōuka / cabbage tree (*Cordyline australis*) was present.

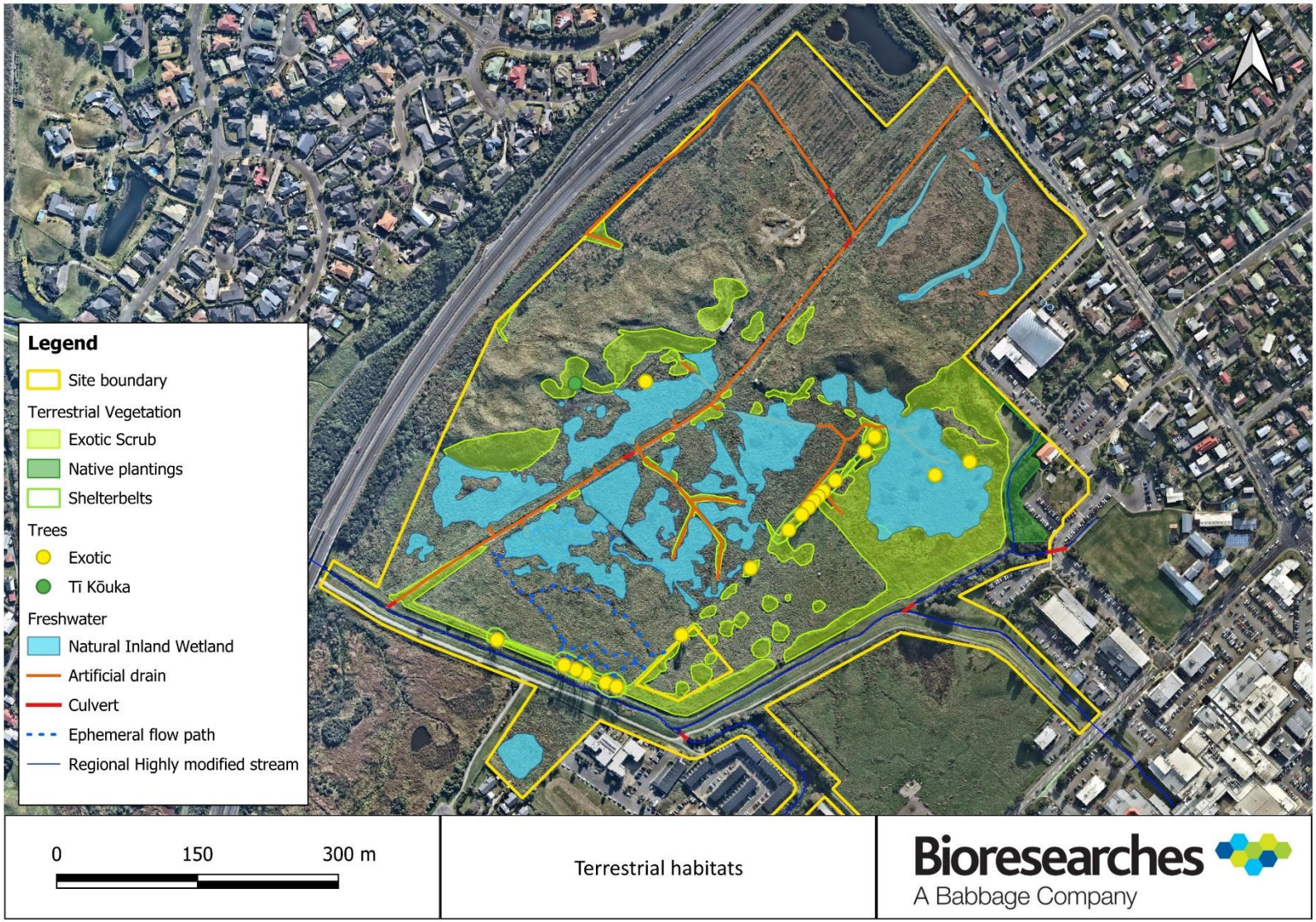


Figure 12. Terrestrial vegetation types identified within the site.

5.1.2.1 Exotic grassland

The exotic grassland habitat included common, exotic grasses and pasture species such as ryegrass (*Lolium perenne*), white clover (*Trifolium repens*), dock (*Rumex* sp.), yarrow (*Achillea millefolium*), and cocksfoot (*Dactylis glomerata*). Much of the grassland within the site had been recently grazed and/or mown, and consequently, there was limited biomass within much of this habitat unit (Photo 1 and Photo 2).

The exotic grassland is not representative of any naturally occurring habitat type. As this habitat contained no or very low incidences of native plant species, and was not representative of a naturally occurring habitat type, it was considered to have **Negligible** botanic value.

In its current, mown/grazed state, the grassland has very limited ecological value, however it may be occasionally used for nesting by some birds such as pūkeko (*Porphyrio melanotus melanotus*; Not Threatened), and although the likelihood is very low, and has not been recorded, by New Zealand dotterel (*Charadrius obscurus aquilonius*; Threatened, Nationally Increasing).

Considering the negligible botanical value of the habitat, in combination with the fact that the poor representativeness and the fact that the habitat only is known to support Not Threatened species for more than occasional foraging, the exotic grassland habitat was assigned a **Negligible** ecological value.



Photo 1. Example of exotic grassland habitat within the site



Photo 2. Example of exotic grassland habitat within the site

5.1.2.2 Exotic scrubland

The exotic scrubland habitat occurred in sporadic patches throughout the site, and was vegetated with either blackberry and/or gorse, the former more often present in wetter areas whilst gorse was present in drier areas (Photo 3 and Photo 4). In patches of this habitat where scrub was sparser, exotic grassland species were present throughout, but in denser thickets, the shrubland was generally a monoculture of either blackberry or gorse. Both blackberry and gorse are listed as pest plants in the Greater Wellington Regional Pest Management Plan (GWRC, 2019). Occasional other species present included inkweed (*Phytolacca octandra*) and brush wattle seedlings and saplings (*Paraserianthes lopthana*).

The exotic scrubland is not representative of any naturally occurring habitat type. Consequently, this habitat is considered to have **negligible** botanic value.

The scrubland may occasionally provide some food for native bird species, such as when the blackberry is flowering or fruiting, and could provide nesting habitat for At Risk – Declining pipit. However, birds consuming the blackberry will spread its seeds, contributing to the spread of this pest plant. The habitat may also potentially provide habitat for native skinks, such as northern grass skink (*Oligosoma polychroma*), however it is highly unlikely to support arboreal lizard species such as geckos.

Considering the botanical value of the vegetation and its ability to provide habitat for native fauna, the ecological value of this habitat was considered to be **Low**.



Photo 3. Closeup example of exotic scrubland habitat within the site



Photo 4. Overview photo showing the localised patches of exotic scrubland habitat within the site

5.2 Avifauna (manu)

The avifauna of the site and surrounding landscape was investigated through (1) a desktop assessment involving a review of historic records of birds within 5 km of the site held in online databases (e.g., *ebird.org; iNaturalist.org*), and (2) birds reported during the site visit. The primary aim of the avifauna investigation was to determine the presence of 'Threatened' or 'At Risk' bird species (Robertson *et al*., 2021) and assess the significance of native bird habitat features within the site.

5.2.1 Desktop Study

Table 1 lists the avifauna recorded by desktop databases, with a threat status of 'At-Risk' or higher. Avifauna recorded with a threat status of 'Not Threatened' or 'Non-Resident' can be found in Table 18, Appendix 3.

Sea birds (due to a lack of any marine or coastal habitat within the site) and non-native species were excluded. Pond or lake-dwelling species have been included, due to the presence of a large and vegetated pond just outside the site's northern boundary, as well as a smaller pond to the south-east (



Figure 13). Estuarine birds found either on the mainland or within the Waikanae Estuary Scientific Reserve have also been included, as they may have use of the site during certain conditions (discussed below).

Table 1. Native avifauna identified during the desktop study, corresponding conservation status (Robertson et al., 2021) and likelihood of presence within the site.

Conservation status	Common name	Scientific name	Record source	Likely present
Threatened - Nationally Critical	White heron *Waikanae Reserve	*Ardea modesta*	New Zealand Bird Atlas	No
Threatened - Nationally Endangered	Black-fronted tern *Waikanae Reserve	*Chlidonias albostriatus*	New Zealand Bird Atlas	No
Threatened - Nationally Vulnerable	Caspian tern *Typically estuarine, sighted inland	*Hydroprogne caspia*	New Zealand Bird Atlas, iNaturalist	No
	Hutton's shearwater *Waikanae Reserve	*Puffinus huttoni*	New Zealand Bird Atlas	No
Threatened – Nationally Increasing	Pāteke / Brown teal *Waikanae Reserve	*Anas chlorotis*	New Zealand Bird Atlas, iNaturalist	No
	Wrybill * Waikanae Reserve	*Anarhynchus frontalis*	New Zealand Bird Atlas, iNaturalist	No
	Bush falcon	*Falco novaeseelandiae ferox*	iNaturalist	No

	New Zealand dabchick *pond habitat	*Poliocephalus rufopectus*	New Zealand Bird Atlas, iNaturalist	Yes (on the stormwater pond)
	New Zealand dotterel * Waikanae Reserve	*Charadrius obscurus aquilonius*	iNaturalist	Yes
	North Island kokako *Kapiti Island, forest habitat mainland	*Callaeas wilsoni*	New Zealand Bird Atlas	No
At Risk – Declining	South Island pied oystercatcher * Waikanae Reserve	*Haematopus finschi*	New Zealand Bird Atlas	No
	Eastern bar-tailed godwit * Waikanae Reserve	*Limosa lapponica baueri*	New Zealand Bird Atlas	No
	North Island fernbird * Waikanae Reserve	*Bowdleria punctata vealeae*	New Zealand Bird Atlas, iNaturalist	No
	Lesser knot * Waikanae Reserve	*Calidris canutus rogersi*	New Zealand Bird Atlas	No
	White-fronted tern *sighted close to site	*Sterna striata striata*	New Zealand Bird Atlas, iNaturalist	No
	New Zealand pipit	*Anthus novaeseelandiae novaeseelandiae*	New Zealand Bird Atlas, iNaturalist	Yes
	Banded dotterel * Waikanae Reserve	*Charadrius bicinctus bicinctus*	New Zealand Bird Atlas, iNaturalist	No
At Risk – Recovering	kākā / North Island kākā	*Nestor meridionalis septentrionalis*	New Zealand Bird Atlas, iNaturalist	No
	Variable oyster catcher * Waikanae Reserve	*Haematopus unicolor*	New Zealand Bird Atlas	No
	Pied shag *inland sightings	*Phalacrocorax varius varius*	New Zealand Bird Atlas	No
	little shag, kawau paka *usually marine	*Phalacrocorax melanoleucos brevirostris*	New Zealand Bird Atlas, iNaturalist	No
	Black shag *marine and pond habitats	*Phalacrocorax carbo novaehollandiae*	New Zealand Bird Atlas, iNaturalist	No
	kākāriki / red-crowned parakeet	*Cyanoramphus novaezelandiae novaezelandiae*	iNaturalist	No
	North Island Saddleback *Kapiti Island, Waikanae Reserve	*Philesturnus rufusater*	New Zealand Bird Atlas, iNaturalist	No
At Risk – Naturally Uncommon	Royal spoonbill *pond habitat	*Platalea regia*	New Zealand Bird Atlas	No
	Black-fronted dotterel * Waikanae Reserve	*Elseyornis melanops*	New Zealand Bird Atlas, iNaturalist	No
	little black shag * Waikanae Reserve	*Phalacrocorax sulcirostris*	New Zealand Bird Atlas, iNaturalist	No
	Australian coot *pond habitat	*Fulica atra australis*	New Zealand Bird Atlas, iNaturalist	No



Figure 13. Location of two ponds to the north and south-east of the site, just outside the boundary.

5.2.2 Opportunistic Sightings On-Site

Table 2 lists the bird species identified opportunistically on site during the site visit.

Table 2. Avifauna observed on-site and corresponding NZ conservation status (Robertson et al., 2021).

	Common name	Species name	Conservation status
Indigenous	kōtare / New Zealand kingfisher	*Todiramphus sanctus vagans*	Not Threatened
	pūkeko	*Porphyrio melanotus melanotus*	Not Threatened
	Spur-winged plover	*Vanellus miles*	Not Threatened
	New Zealand pipit	*Anthus novaeseelandiae*	Naturally uncommon
	rirorirо / grey warbler	*Gerygone igata*	Not Threatened
	welcome swallow	*Hirundo neoxena neoxena*	Not Threatened
Exotic	mallard	*Anas platyrhynchos*	Introduced and Naturalised
	house sparrow	*Passer domesticus*	Introduced and Naturalised
	magpie	*Gymnorhina tibicen*	Introduced and Naturalised
	starling	*Sturnus vulgaris*	Introduced and Naturalised
	paradise shelduck	*Tadorna variegata*	Introduced and Naturalised
	Canada goose	*Branta canadensis*	Introduced and Naturalised
	blackbird	*Turdus merula*	Introduced and Naturalised
	European goldfinch	*Carduelis carduelis*	Introduced and Naturalised
	chaffinch	*Fringilla coelebs*	Introduced and Naturalised
	Yellowhammer	*Emberiza citrinella*	Introduced and Naturalised
	song thrush	*Turdus philomelos*	Introduced and Naturalised

5.2.3 Ecological Value for Avifauna

Only one Threatened 'At Risk' bird species was confirmed to be present on site during the site visit – the New Zealand pipit (At Risk – Declining), which was observed foraging within the site within the open grassland areas. This species widespread in their habitat preferences, ranging from open coastal and alpine habitats, to rivers, wetlands, felled pine forests and farmlands. They prefer to nest in low shrubbery, such as clumps of grass under ferns or tussock, and as such the scrubland on site could be used as breeding habitat.

A large number of avifauna species with a threat status of 'At-Risk' or higher have been recorded within 5 km of the site during the desktop study. Several factors have influenced this large quantity of high-value species, and a cautionary approach has been utilised when assessing the potential presence of these species within the site boundary.

The proximity of the site to Kāpiti Island, and its associated abundance of high-value avifauna, increases the potential of these species to be present within the site. Given the island is only 5 km from the shore, there is a chance bird species may travel from the island to the mainland, or be blown across in a storm, and this may explain some of the sightings of rare species within the 5 km radius from the site. For example, the North Island kōkako (Threatened – Nationally Increasing), and the kākāriki and North Island saddleback (At

Risk – Recovering) are species typically found on Kāpiti Island, but have occasionally been sighted on the mainland. It is highly unlikely that these species would use the site for habitat, given the lack of tree cover and their preference for mature forest.

Waikanae Estuary Scientific Reserve, located 3.8 km from the site, hosts a large number of estuarine species. However, some of these species have been recorded on inland farms adjacent to the site (such as the pied shag and white-fronted tern). It is known that typically-estuarine birds may occasionally use inland farms and ponds to roost and shelter, especially during neap high tides or storm events. Given the site's proximity to the coast (approximately 1.3 km), it is possible that these birds may use the open land or adjacent ponds for habitat. This is particularly true for species of shags, spoonbills and oystercatchers, and also includes pond-inhabiting species that may be occupying the adjacent ponds and habitat just outside of the site boundary.

The bush falcon / kārearea (*Falco novaeseelandiae ferox,* 'Threatened – Nationally Increasing'), was sighted numerously across both open farmland and adjacent forest within 5 km of the site. The falcon typically breeds on the ground, and prefers forest habitat with minimal shrubbery/groundcover. They have been known to roost in recently felled pine forest, and as such have a diverse range of habitat preference. They are typically absent from agricultural settings, but may use farmland for breeding if some stands of trees remain. They have also been found breeding and foraging in Wellington City, so the presence of kārearea cannot be ruled out from the site, although it is unlikely that they would visit the site other than for foraging.

The North Island kākā (*Nestor meridionalis septentrionalis* – 'At Risk – Recovering') was also sighted on the mainland within 5 km of the site. Kākā are known to prefer foraging in forests, eating nectar of natives such as flowering rātā, wood-boring insects, or seeds of podocarps. Nests are typically built 5 metres or more from the ground, and as such the lack of dense, mature forest or food sources means that this species are highly unlikely to visit the site.

The site is confirmed to provide habitat for Not-Threatened and At Risk-Declining native birds. For some of these species, such as pūkeko this will include habitat for breeding and nesting. Habitat for threatened species within the site is limited, and it is unlikely that these species would use the site for more than temporary visits, although they may more frequently visit adjacent habitats such as the wetlands south of the site. Considering these factors, the site is considered to have a **moderate** ecological value for avifauna.

5.3 Herpetofauna

Herpetofauna (reptiles and amphibians) comprise a significant component of New Zealand's terrestrial fauna. One hundred and twenty-nine (129) terrestrial taxa are currently recognised (van Winkel *et al.*, 2018; Hitchmough et al., 2021) and over 85% of these are considered 'Threatened' or 'At Risk' of extinction (Hitchmough *et al*., 2021; Burns *et al.,* 2018).

All native reptiles and amphibians are legally protected under the Wildlife Act 1953, and its subsequent amendments, and vegetation and landscape features that provide significant habitat for native herpetofauna are protected by the RMA 1991. Exotic (i.e., 'Introduced and naturalised') species are not afforded legal protection and therefore, there are no statutory requirements to manage or mitigate for adverse ecological effects on exotic herpetofauna.

5.3.1 Desktop Assessment

The indigenous herpetofauna of the Wellington Region includes 17 terrestrial taxa, of which five have become extirpated or extinct from the mainland. A further three introduced species are also known to occur in

the region. These species are listed in Table 3, sourced from the Department of Conservation herpetofauna database and iNaturalist records.

Table 3. Terrestrial herpetofauna of the Wellington region (mainland), corresponding Wellington mainland and NZ conservation statuses, and reported occurrence within 5 km of the site.

	Common Name	Species Name	Wellington Mainland Threat Status*	NZ Threat Status**	Found ≤ 5km of site
Indigenous	*Dactylocnemis pacificus*	Pacific gecko	Data deficient	Not Threatened	
	Oligosoma whitakeri	Whittaker's skink	Critical	Endangered	
	Oligosoma aff.infrapuncta-tum"southern NorthIsland"	Kupe skink	Critical	Critical	
	Naultinus punctatus	Mokokākāriki/ barkinggecko	Vulnerable	At Risk – Declining	✓
	Oligosoma aeneum	Copper skink	Vulnerable	At Risk – Declining	✓
	Oligosoma ornatum	Ornate skink	Vulnerable	At Risk – Declining	
	Oligosoma zelandicum	Glossy brown skink	At Risk - Declining	At Risk - Declining	
	Mokopirirakau "southern NorthIsland"	Ngahere gecko / forest gecko	At Risk - Declining	At Risk - Declining	✓
	Woodworthia "Marlborough mini"	Minimac gecko	At Risk - Declining	At Risk – Declining	
	Oligosoma kokowai	Northern spotted skink	Endangered	At Risk - Relict	
	Oligosoma polychroma	Northern grass skink	Not Threatened	Not Threatened	✓
	Woodworthia maculata	Moko pāpā/ Rauka-wagecko	Not Threatened	Not Threatened	✓
Introduced	*Lampropholis delicata*	Plague skink		Introduced & Naturalised	✓
	Ranoidea raniformis	Southern bell frog		Introduced & Naturalised	✓
	Litoria ewingii	Whistling tree frog		Introduced & Naturalised	✓

* Crisp *et al.* (2023)

** Hitchmough *et al.* (2021)

The herpetofauna databases reviewed indicated that six indigenous species have been recorded within 5 km of the site (Figure 14). The Ngahere gecko (*Mokopirirakau* 'southern North Island' – At Risk – Declining) was found along the northern boundary of the site, however this record dates back to 1968 when indigenous forest remained on the site. The barking gecko (*Naultinus punctatus*) and copper skink (*Oligosoma aeneum*) (both 'At Risk – Declining), as well as the northern grass skink (*Oligosoma polychroma* – Not Threatened) were identified on similar, open farmland habitats within the 5 km radius. The Raukawa gecko (*Woodworthia maculata* – Not Threatened) was also found ~3km from the Site.

Boffa Miskell (2022) reported that they conducted a survey within the site for skinks, but did not publish the results.



Figure 14. Lizard records from the DOC Herpetofauna records (sourced September 2026) within 5km of the Site

5.3.2 Field Assessment

Despite the survey efforts (192 ACO inspections, and four hours of VES) across four days of suitable weather conditions (Table 4) and there being suitable habitat identified on site, no native lizards or sign (i.e., scat) was found.

It remains possible that indigenous lizards persist within the site; however, if present, they are likely to occur at low densities. The site has been subject to substantial historical modification, including extensive forest clearance prior to 1958, subsequent use as grazed pasture, and further vegetation clearance in 2018 associated with construction of the MacKays to Peka Peka Expressway and the stormwater pond in the northern part of the site (Figure 9). These activities are likely to have substantially reduced the extent, quality and connectivity of available lizard habitat.

The absence of detections may also reflect limited opportunities for recolonisation and ongoing predation pressure from introduced mammals. The site is fragmented from surrounding habitat by roads and development, restricting movement between the site and potential source populations. Several mice were also recorded beneath ACOs during the survey. Mice are known to adversely affect indigenous skink populations and their presence may influence skink use of certain ACOs.

Hand-searching was also constrained within some areas of otherwise suitable habitat, including piles of corrugated iron and stacked timber. These features were heavily overgrown and, in some instances, could not be readily lifted or safely searched (Photo 5), reducing the effectiveness of VES within these areas.

Indigenous lizards have been recorded within 5 km of the site, including a historic record of ngahere gecko near the present-day stormwater pond in the northern part of the site. However, this record dates from 1968 and, given the subsequent extensive clearance of indigenous forest and associated habitat loss, it is considered highly unlikely that an extant ngahere gecko population persists on site. Although other indigenous lizard records occur within 5 km, the extent of historical vegetation clearance and land-use modification, together with the site's isolation by surrounding roads and the highly modified nature of the wider landscape, is likely to substantially limit opportunities for dispersal and recolonisation from surrounding populations.

No plague skinks (*Lampropholis delicata*), which are listed as an Unwanted Organism under the Biosecurity Act 1993, were detected during the survey.

Table 4. Weather and survey data

Date	28th April	29th April	30th April	1st May
Time Range	10am-1pm	13:00pm - 16:00pm	8:00am - 11am	9:30am – 12:30pm
Temperature	15-20 degrees	20-25 degrees	15-20 degrees	15-20 degrees
Weather	Overcast	Partly cloudy	Overcast	Light drizzle

Note. Rain, air temperature sourced from www.wunderground.com (station IPARAP20 for temperature, 40.92° S, 175.012° E; station IPARAP38 for rainfall, 40.916° S, 175.013° E). Stations record data continuously.



Photo 5. Areas of potential lizard habitat on Site within dense rubbish piles and rank grassland.

Although the survey resulted with no lizard detections on site, the potential presence of skinks cannot be entirely dismissed. Lizards are cryptic and several species are highly adaptable and capable of persisting in, or dispersing into, highly modified landscapes, particularly several species of native skinks. The proposed works therefore have the potential to disturb native skinks utilising the exotic scrubland habitat on site, which could result in the complete loss of a lizard population within the site. As native lizards (skinks) are protected under the Wildlife Act (1953), a Lizard Management plan (LMP) is recommended to be implemented on Site during the Project to minimise the risk of death or injury to native lizards.

5.3.3 Ecological Value for Herpetofauna

Since grazing ceased, vegetation (mostly kikuyu) has regenerated across much of the site, providing suitable habitat for indigenous lizards, particularly ground-dwelling skinks. Areas of greater structural complexity, including around the shed, corrugated iron, pampas, and areas of scrubland, are considered to provide the highest-value lizard habitat within the site.

The species most likely to occur are ground-dwelling skinks, particularly northern grass skink (*Oligosoma polychroma*; regionally and nationally Not Threatened) and copper skink (*O. aeneum*; regionally Threatened, nationally At Risk). Both species have been recorded within 5 km of the site and suitable habitat is present within the site. Northern grass skink is considered more likely to occur than copper skink due to its greater tolerance of modified and open habitats.

Although a native gecko has previously been recorded (1968) immediately adjacent to the site, it is considered unlikely that an extant population persists. The mature shrubland and forest habitat formerly present has been extensively cleared, removing the habitat most likely to have supported arboreal geckos. Ground-dwelling geckos, such as *Woodworthia* spp., could potentially persist where rocky substrates and dense ground cover are present; however, no such species have previously been recorded from the site.

Although no lizards were detected during the survey, it remains possible that indigenous skinks persist within the site, however most likely at low densities. On this basis, the ecological value of the site for lizards is considered **Moderate** reflecting the potential for TAR lizards (most likely skinks) to be on site, with this value primarily associated with the exotic scrubland and structurally complex ground-level habitats.

5.4 Bats (pekapeka)

Two endemic species of bats (pekapeka) are found in New Zealand, including the long-tailed bat (LTB; *Chalinolobus tuberculatus*) and short-tailed bat (STB; *Mystacina tuberculata*); the latter is represented by three subspecies (O'Donnell *et al.,* 2018). Both species are listed as 'Threatened' or 'At Risk' under the New Zealand threat classification system (i.e., LTB - 'Nationally Critical' and Southern STB – 'At Risk – Recovering') (Townsend *et al*., 2008; O'Donnell *et al*., 2018). Their threat statuses reflect the drastic and ongoing decline in populations across much of New Zealand, due to the loss and fragmentation of habitats and adverse impacts of pest mammals (e.g., rodents, cats), with some population recovery from conservation management apparent in Southern STB populations.

5.4.1 Desktop Assessment

Department of Conservation bat records were assessed within the vicinity of the site (Figure 15). No bats were recorded within five km of the site - the closest record was for an LTB, 9.5 km to the north-west of the site on Kāpiti Island. On the mainland, the closest records were 23.5 km for an unknown bat species, and 22 km for a lesser STB. These fell within dense forest environments, with the exception of one lesser STB being recorded within the urban setting of Featherston, approximately 1.5 km from mature forest.

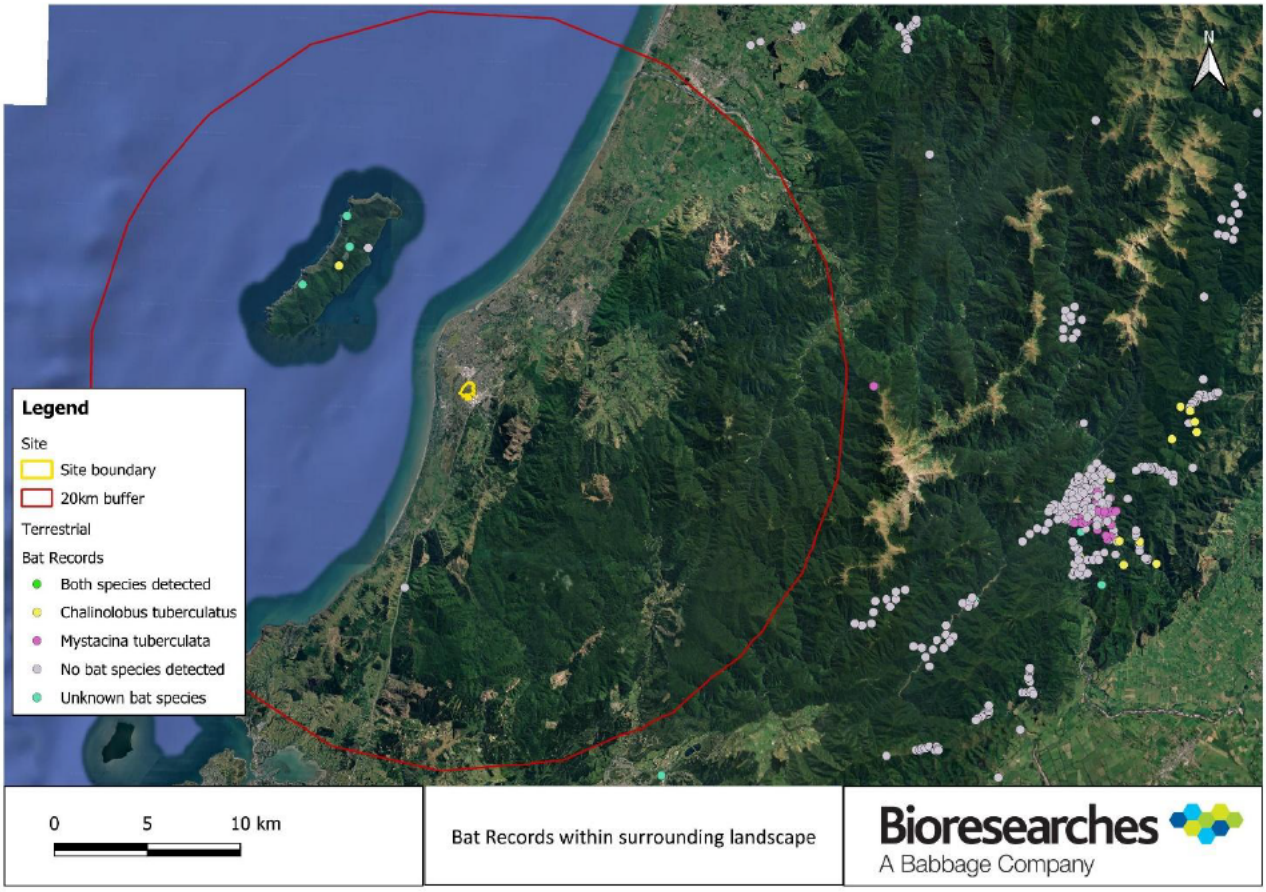


Figure 15. Bat records within the vicinity of the site

5.4.2 Field Assessment

An average of 36 valid nights of data per unit (range 24-44) was obtained for the five ABMs deployed during the bat survey, with three nights deemed invalid due to rainfall (Table 5). No bat activity was detected during the survey on Site. Weather data and survey analytics is provided in Table 6.

Table 5. November 2024 bat survey data

Recorder location	Date set	Date complete	Number of valid nights	Number of bat passes
1	13/11/2024	06/01/2025	31	0
2	13/11/2024	30/12/2024	24	0
3	13/11/2024	13/01/2025	38	0
4	13/11/2024	17/01/2025	42	0

5	13/11/2024	19/01/2025	44	0

Note: 'Valid' nights determined using criteria from DOC's Bat Roost Protocols (Department of Conservation, 2024)

Table 6. Weather data and valid nights during bat survey

Date	Official sunset	Min temp within 4 hrs after sunset (°C)	Max wind speed within 4hrs after sunset (km/hr)	Rainfall within 4hrs after sunset (mm)	Valid night?
3/12/24	20:37	17.3	7.2	0	Yes
4/12/24	20:38	16.9	9.0	0	Yes
5/12/24	20:39	14.6	14.0	0	Yes
6/12/24	20:40	15.2	0.0	0	Yes
7/12/24	20:41	16.4	9.7	0	Yes
8/12/24	20:42	16.2	11.1	11.94	**No**
9/12/24	20:43	15.4	9.0	0	Yes
10/12/24	20:44	15.0	6.4	0	Yes
11/12/24	20:45	16.3	5.0	0	Yes
12/12/24	20:45	15.8	2.9	0	Yes
13/12/24	20:46	17.2	7.2	0	Yes
14/12/24	20:47	17.8	6.4	0	Yes
15/12/24	20:48	17.4	4.0	0	Yes
16/12/24	20:48	13.1	7.6	17.28	**No**
17/12/24	20:49	10.0	6.1	0	Yes
18/12/24	20:50	13.3	2.6	0	Yes
19/12/24	20:50	16.0	1.1	0	Yes
20/12/24	20:51	15.5	0.0	0	Yes
21/12/24	20:51	15.9	2.1	3.55	Yes
22/12/24	20:52	17.2	8.7	0	Yes
23/12/24	20:52	17.5	6.1	0	Yes
24/12/24	20:53	16.7	2.9	0	Yes
25/12/24	20:53	16.4	0.0	0	Yes
26/12/24	20:53	16.0	5.0	7.62	**No**
27/12/24	20:54	12.0	7.6	0	Yes
28/12/24	20:54	12.7	0.0	0	Yes
29/12/24	20:54	17.5	7.9	0	Yes
30/12/24	20:54	14.9	5.0	0	Yes
31/12/24	20:54	13.5	3.5	0	Yes
1/01/25	20:54	12.5	1.4	3.56	Yes
2/01/25	20:55	16.6	6.4	0	Yes
3/01/25	20:55	13.6	3.5	3.55	Yes
4/01/25	20:55	13.9	5.0	0	Yes
5/01/25	20:55	12.4	7.2	0	Yes
6/01/25	20:54	14.2	1.1	0	Yes
7/01/25	20:54	15.9	4.7	0	Yes

8/01/25	20:54	12.0	6.4	0	Yes
9/01/25	20:54	10.9	0.0	0	Yes
10/01/25	20:54	12.3	0.3	0	Yes
11/01/25	20:53	11.4	4.0	0	Yes
12/01/25	20:53	12.1	2.1	0	Yes
13/01/25	20:53	10.6	0.0	0	Yes
14/01/25	20:52	10.2	0.0	0	Yes
15/01/25	20:52	12.0	0.3	0	Yes
16/01/25	20:51	12.7	0.0	0	Yes
17/01/25	20:51	14.2	0.0	0	Yes
18/01/25	20:50	14.1	0.0	0	Yes

Note. Official sunset time obtained from www.timeanddate.com. Rain, air temperature, and wind speed data sourced from www.wunderground.com (station IPARAP20 for temperature and wind speed, 40.92° S, 175.012° E; station IPARAP38 for rainfall, 40.916° S, 175.013° E). Stations record data continuously.

5.4.3 Ecological Value for Bats

STBs have far more specific habitat requirements than LTBs (mature forest with minimal introduced predators) and are far less mobile. Consequently, STBs are highly unlikely to be present within the site given that its closest recording is over 20 km from the site.

There are some small pockets of mature, exotic trees present onsite. However, the highly modified condition of the site, a general lack of mature vegetation, setting within an urbanised environment, and lack of recordings during the survey and within 5 km of the site, indicates that the probability of bats being present on the site is very low. Consequently, the ecological value of the site for bats is considered to be **Negligible**, and bats have not been considered further within this assessment.

5.5 Freshwater Habitats

5.5.1 Desktop Assessment

As described previously, the Wharemaukū Stream flows adjacent to the site's south-eastern and southern boundaries; and the site is bisected by one main watercourse (hereafter, Watercourse 1), with several smaller drains present which discharge into Watercourse 1. These smaller drains all appear to have been constructed since 1951.

Analysis of GWRC GIS maps classifies Watercourse 1 as a 'highly modified stream', and also depicts two additional highly modified streams (the lower reach of Drain 4 and a side 'arm' of Drain 3) and three other natural watercourses with the site, including much of Drain 3, and two other drains which are not visible on aerial maps, but were identified by the digital elevation model used to map the streams (Figure 16).



Figure 16. GWRC 'Regional Highly Modified Streams' overlay relative to the site. Pink lines indicate highly modified streams whilst blue lines indicate natural watercourses.

In addition to the stream habitats described above, multiple wetland-like habitats were visible on present day and historic aerial imagery. These wetlands all appear to be highly modified and do not appear to contain natural wetland vegetation.

5.5.1.1 Freshwater fish

A desktop search for native fish records, using the New Zealand Freshwater Fish Database (NZFFDB), was undertaken within the Wharemaukū Stream catchment. This retrieved records of seven native fish species, including one Threatened fish species, and three At Risk – Declining fish species; as well as kōura and freshwater shrimp (Table 7).

Table 7. New Zealand freshwater fish database records for the Wharemaukū Stream catchment

Common Name	Scientific Name	Threat Classification*
Shortfin eel	*Anguilla australis*	Not threatened
Longfin eel	*Anguilla dieffenbachii*	At risk - Declining
Kōaro	*Galaxias brevipinnis*	At risk - Declining
Banded kōkopu	*Galaxias fasciatus*	Not threatened
Īnanga	*Galaxias maculatus*	At risk - Declining

Shortjaw kokopu	*Galaxias postvectis*	Threatened – Nationally vulnerable
Common bully	*Gobiomorphus cotidianus*	Not threatened
Kōura/ freshwater crayfish	*Paranephrops planifrons*	Not threatened
Freshwater shrimp	*Paratya curvirostris*	Not threatened

* = Freshwater fish threat classifications from Dunn *et al.* (2017); freshwater invertebrate threat classifications from Grainger *et al.* (2018).

In addition to this, a search for local records of brown mudfish (*Neochanna apoda*; At Risk - Declining) was undertaken separately to the search for fish records. The search area was widened from that of the other search as this species inhabits wetlands, drains (both of which are present onsite) and forest pools, many of which dry up in summer, and consequently aren't often detected in general fish surveys. This identified brown mudfish records within 2.5 km of the site, and multiple additional records further north in similar dune-wetland habitats, which often appeared to also be degraded (Figure 17). No records were detected further south within the wider dune system.

Brown mudfish are known to occur most frequently in forest pools beneath kahikatea-dominated forest and shallow, ephemeral dune swamps, which is the likely habitat present at the site prior to vegetation clearance and wetland drainage.

Considering extensive habitat disturbance which has occurred at the site, it is unlikely that mudfish have persisted within the site, although it is not impossible; for example, it is recorded that the "majority of *Neochanna* populations occur in productive low-lying areas influenced by agricultural activities" (O'Brien & Dunn, 2007) and have been identified in overgrown drains. In addition, brown mudfish are non-diadromous, and so do not require connectivity to the sea to persist in an environment.

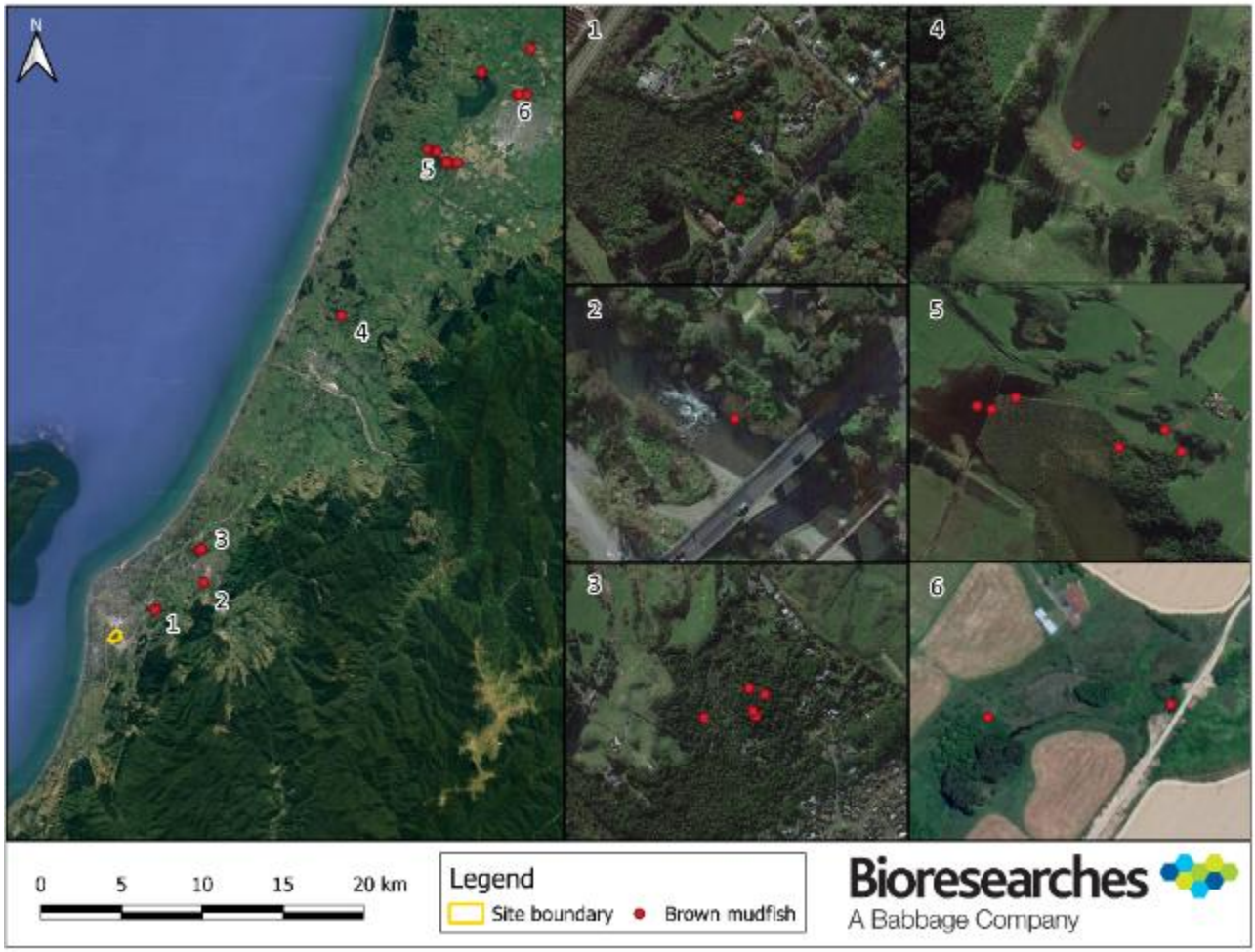


Figure 17. Local NZFFDB brown mudfish records. Left is a map of showing the general location of records relative to the site, and the inset maps indicate the habitat types where the records are located.

5.5.2 Freshwater Fish Survey

Targeted fish surveys were undertaken within the Wharemaukū Stream and Watercourse 1 utilising a combination of overnight trapping and eDNA. Overnight trapping was undertaken in 2023 and 2024 in which six Gee's minnow traps (GMT's) and three fyke net were set in the Wharemaukū Stream. Within Watercourse 1, a single fyke and two Gee's minnows traps were left overnight in the lower section of the drain. Unlike the upper drain, the lower section of the drain just had sufficient water depth to use the fyke, and although the oxygen saturation in the water was low (48% dissolved oxygen), the nets and traps were set with an air gap to prevent oxygen starvation of captured fish.

In 2024, targeted mudfish surveys were undertaken in which six GMT's were set within four sites within the drains, targeting areas where wetlands drain and habitat which may be attractive to mudfish (e.g. near culverts). Three replicate eDNA samples were collected at two sites in the main drain (Watercourse 1) running from Kapiti Road to the Wharemaukū Stream. The upper site was located immediately downstream at the confluence of the drains from the west; the lower site was located immediately downstream of a second culvert, near where the drainage from Wetlands 3, 4 and 5 would discharge (Figure 18).

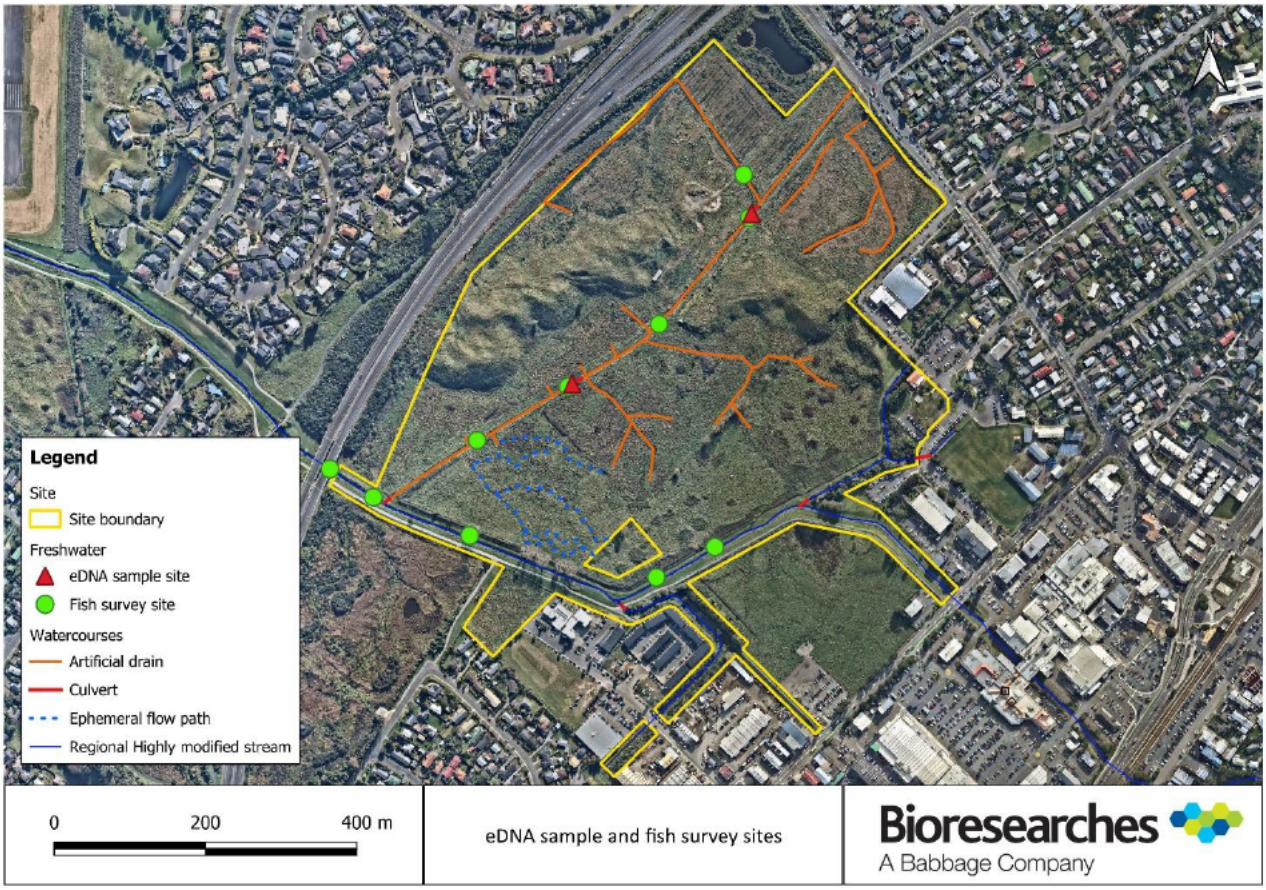


Figure 18. Site map with location of fish survey site and sites where eDNA samples were collected

Within the Wharemaukū Stream īnanga (*Galaxias maculatus*), both adult and a single early whitebait, redfin bully (*Gobiomorphus huttoni*), common bully (*Gobiomorphus cotidianus*) and freshwater shrimp (*Paratya curvirostris*) were caught. Damage to the one of the nets was indicative of an adult eel, likely a large shortfin eel (*Anguilla australis).* Within Watercourse 1, four shortfin eel, one longfin eel (*Anguilla dieffenbachi*) and a bully were caught.

Table 8. Freshwater fish species captured during overnight trapping or detected through eDNA.

Survey period	Site	Method	Trapping	eDNA
2023	Wharemaukū Stream downstream	6 x GMT 3 x fykes	Unidentified eel Inanga x 6 Redfin bully x 2 Common bully x 4 Freshwater shrimp	-
	Watercourse 1	2 x GMTs 1 x fyke	Shortfin eel x 4 Longfin eel x 1 Unidentified bull x 1	-
2024	Drain 1	6 x GMT	Nil	-
	Watercourse 1 up-stream	6 x GMT 3 x eDNA	Inanga x2	īnanga, shortfin eel, common bully (plus trace in one replicate of longfin eel).
	Watercourse 1 middle	6 x GMT	Nil	-
	Watercourse 1 down-stream	6 x GMT 3 x eDNA	Inanga x4 Common bully x 1	īnanga, shortfin eel, common bully, longfin eel

5.5.3 Watercourses

Observations of the watercourses onsite confirmed the presence of the Wharemaukū Stream, Watercourse 1, Drains 1 – 4, and the additional six smaller drains. Several overland flow paths are also present in the southern portion of the site. These are naturally meandering, and at the time of the site visit contained no water. All watercourses are depicted in Figure 19.

Despite being classified as a natural stream by the GWRC 'Regional Highly Modified Streams' overlay, Drain 3, which was present in the same general location, was found to be straightened, with no natural meanders and a uniform depth and width. Furthermore, it is not visible in aerial imagery prior to 1998. Consequently, this was classified as an artificial watercourse rather than a natural stream. Additionally, the northern-most and southern-most ‘natural rivers/streams’ present in the GWRC map were found to not exist on site. These findings align with those of Boffa Miskell (2022).

Watercourses identified within the site have been grouped into categories based upon their features, such as size and condition. These are described in additional detail below, with additional summary data presented in Appendix 4, and the justification on the classification of stream types within the Greater Wellington Region is presented in Appendix 6.

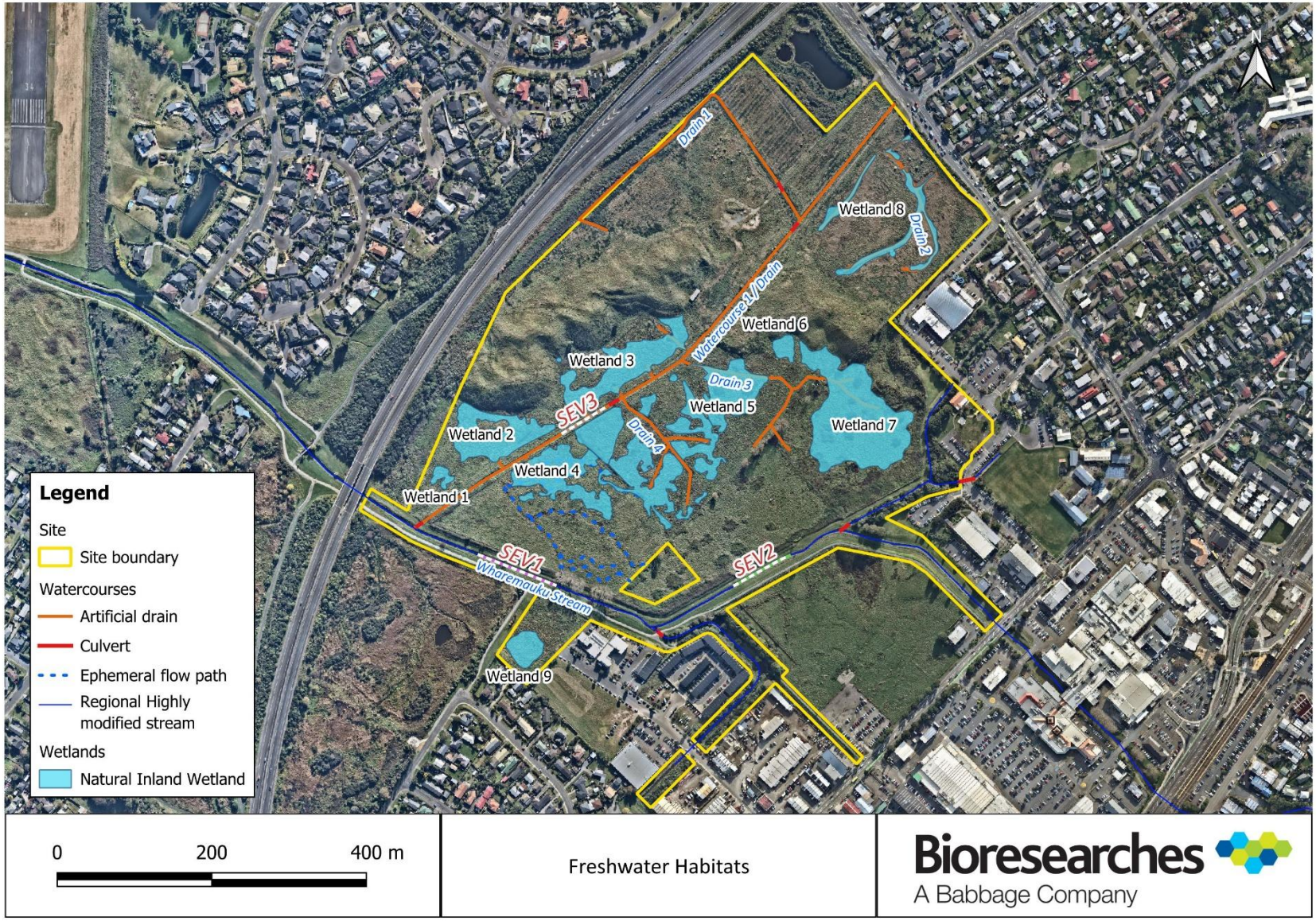


Figure 19. Stream and wetland habitats within the site, and stream ecological valuation assessment areas.

5.5.3.1 Wharemaukū Stream

The Wharemaukū Stream (Photo 6 to Photo 9) is a permanent stream which flows from the Maungakotukutuku Valley, through Paraparaumu and past the site before discharging into the Tasman Sea at Raumati Beach. The portion of the stream adjacent to the site is situated within an artificially straightened channel, which is mapped as a 'highly modified stream' by GWRC (and therefore can be subject to mechanical maintenance as a permitted activity). The following stream description and ecological value assessment pertains to the approximately 600 m portion of the stream which is adjacent to the site.

The straightened channel averaged 2.5 m wide on the south-eastern boundary and up to 3 m wide on the southern boundary. The depth was variable, ranging from uniform shallow gravels beds 0.15 m deep to deeper areas (0.4 m) adjacent to the bank. The substrate within the stream was comprised of small gravels and silt. The prevalence of small gravel substrate is not typical of a lowland stream and consequently it is not known if this is a naturally occurring or an artificial substrate. Hydraulic heterogeneity was low near the site, with the reach consisting of a slow run for almost all of its extent, with one small riffle section observed where gravels were nearly blocking the stream channel. Shading was very low, with the riparian margins consisting almost entirely of managed grass.

Fish and macroinvertebrate habitat was limited to overhanging long grass and macrophytes, the latter were present as both emergent macrophytes in dense swards on the banks of the stream, and as submerged macrophytes within the channel. Species included the invasive pest plant oxygen weed (*Lagarosiphon major*), water celery (*Helosciadium nodiflorum*), parrots feather (*Myriophyllum aquaticum*), pond weed (*Potamogeton* sp.), starwort (*Callitriche stagnalis*) and watercress (*Nasturtium* sp.).

Freshwater fish surveys show īnanga, redfin bully, common bully and freshwater shrimp were caught, and it is assumed an adult shortfin eel was captured and subsequently escaped (Table 8). The native fish index of biological integrity (Fish IBI) for Wellington calculated the native fish integrity to be 'poor' at the downstream site and 'very poor' at the upstream site, when the distance from the coast and the elevation were considered (Appendix 5).

The desktop survey showed all of the Threatened or At Risk (TAR) fish species recorded within the catchment were recorded upstream of the site, indicating that they at least pass through the reach adjacent to the site. Kōaro (*Galaxias brevipinnis*) are good climbers and generally occur in higher velocity streams,[12] further inland than the site, and shortjaw kōkopu (*Galaxias postvectis*) are generally only present in streams with native forest cover. Consequently, these species are unlikely to make the stream reaches near their site permanent habitat. Longfin eels (*Anguilla dieffenbachii*) also prefer more shaded, higher quality streams although still could utilise the reaches adjacent to the site. Finally, īnanga (*Galaxias maculatus*) are poor climbers, and tend to inhabit open rivers, streams and lakes near the coast. Therefore, it is likely that they inhibit the stream reaches near the site in large numbers as even small natural barriers can impede their progress.

Brown mudfish however are considered unlikely to be present within the stream, as they are rarely found in creeks with flowing water (O'Brien & Dunn, 2007).

Two stream ecological valuation (SEV) surveys were undertaken on the stream in July 2023 (Figure 19). The upstream reach SEV score was 0.34, and the lower reach was also 0.34, both indicative of poor-quality stream habitat. Considering the highly modified nature of the stream reach near the site, and the high potential for

[12] Information on species habitat preferences from the NIWA fish atlas factsheets, see https://niwa.co.nz/freshwater/nzffd/NIWA-fish-atlas/fish-finder

At Risk – Declining species to utilise the reaches of the stream near to the site, as well as the instream habitat quality and general condition, this stream is considered to be of **Moderate** ecological value.



Photo 6. Wharemaukū Stream, upstream of the confluence with Watercourse 1



Photo 7. Wharemaukū Stream, upstream of the confluence with Watercourse 1



Photo 8. Wharemaukū Stream, viewed looking downstream. The confluence with Watercourse 1 is visible in the foreground



Photo 9. The channel immediately downstream of the confluence with Watercourse 1. Here, the tannin stained water from Watercourse 1 can be seen mixing with the lighter-coloured water of the Wharemaukū Stream.

5.5.3.2 Watercourse 1 and Drain 1

Watercourse 1 (Photo 10 to Photo 12) predates the earliest aerial imagery available, however, as described earlier, is considered to be wholly artificial; the entire length of its channel artificially straightened and deepened, with the beginning of the channel abruptly beginning approximately 1 km north-east of the site boundary (Figure 7). Whilst it has been labelled as a 'highly modified watercourse' by GWRC, it shows all the characteristics of a drain in which the entirety of the channel is straightened with unnatural angled bends and no visible variation in bank width or formation and no natural headwaters, particularly when compared to the headwaters of the Wharemaukū Stream observable in historic aerial images (Figure 6). The existing and historic channel morphology are evident it was dug out to drain the surrounding landscape to the north to facilitate farming activities Boffa Miskell (2022) describe the watercourse as a drain stating that it *appears to have been constructed to drain land to the north of the site that was impounded by a row of low dunes*, and

natural streams would not have occurred in these locations. In our assessment Watercourse 1 has been classified as an artificial watercourse.

Watercourse 1 was located at the base of a deep (up to 3 m) steep sided drain with an average width of 1.2 m and an estimated average depth of 0.3 m. A representative SEV was carried out on the Watercourse 1 drain (Figure 19), resulting in an SEV score of 0.24, a very low score and indicative of poor stream habitat quality. The shape, form and attributes of upper section of the drain were very similar to the lower section of the drain, aside from the depth of water (shallower) and width of drain (narrower), and the SEV score was assessed as representative of the entire drain. (Refer Appendix 6).

Drain 1 (Photo 13 to Photo 15) is also has a straight and deep channel, however analysis of historic aerial imagery confirms its artificial status, as it was constructed between 1986 and 1998. Regardless of their natural or artificial status, these watercourses have similar features, with straight channels, approximately 1m wide, mechanically formed, straight and steeply angled banks, similar water levels. Both were incised (albeit artificially) and contained stagnant water with no or limited flow.

The depth of the main watercourse and of the largest drain (Drain 1) indicate they are likely to intersect the groundwater table and contain water for most, if not all of the year, and consequently, they are considered to be permanently wet.

Water quality in these watercourses appeared poor, with algal mats and iron oxidising bacterial films and flocculant present in both channels. Water clarity was low, and the water was tannin stained, reflective of the local peat soils. Hydraulic heterogeneity was low, with the entire reaches of both watercourses consisting of stagnant water or slow run sections.

Habitat for fish and macroinvertebrates was limited to small amounts of overhanging vegetation and patches of macrophytes. Shading was moderate to low, and whilst some was generated from adjacent scrubby vegetation, the remainder was provided by the steep banks. The lack of or slow flow, limited shading and the dark colour of the water, likely mean that the water temperatures in summer rise to levels which limit the fauna which are able to persist in the watercourses. Fish surveys, including netting/trapping and eDNA sampling indicates shortfin eel, longfin eel, common bully and īnanga are present within Watercourse 1. From the fish captured during the netting/trapping phase, the fish IBI for the site was 22 ‘poor’, when assessed against other Wellington watercourses, elevation and distance from the coast (Appendix 5).

Due to the poor quality of instream habitat, the stream is likely only inhabited by fish taxa which are more tolerant of pollution, such as shortfin eels and common bullies, and only in the lower reaches near the Wharemaukū Stream. It highly unlikely that mudfish would be present in these watercourses, considering the habitat modification and their absence in eDNA and trapping efforts.

Considering all of the factors described above, Watercourse 1 and Drain 1 were assigned a **Low** and **Negligible** ecological value respectively.



Photo 10. Watercourse 1



Photo 11. Watercourse 1



Photo 12. Watercourse 1



Photo 13. Drain 1



Photo 14. Drain 1



Photo 15. Drain 1

5.5.3.3 Drain 2

Drain 2 refers to a network of drains in the northern portion of the site associated with the wetlands, constructed to drain the wetland which was previously present in that area. It is difficult to tell when these drains were constructed, however it appears this occurred when vegetation was cleared from the area in 2018, with the drains absent in aerial images between 1942 - 2016.

No obvious outlet to these drains was observed. It is possible they drain north under Kapiti Road via an obscured culvert, although this seemed unlikely. The drains contained some areas of standing water where they intersected the high water table but contained no linkages to other aquatic habitat and consequently are highly unlikely to support native fish species. The drain channels are vegetated with wetland plants were therefore considered to more closely match the definition of 'wetlands' rather than 'watercourses'. Consequently, this habitat unit has instead been described and assigned an ecological value in Section 5.5.4.

5.5.3.4 Drains 3 and 4

Drains 3 and 4 are artificially constructed, meeting the classification of an artificial drain, with the drains absent in aerial images prior to 1998 - 2005. Both drains include multiple smaller drains feeding into one channel, which then discharges into Watercourse 1. The drains at the time of the site visit in May 2023 contained water where the drain was sufficiently deep to intersect the water table; but contained no or limited flow. All of the drains were completely dry in May 2024.

Like Watercourse 1 and Drain 1, water quality was low. Instream habitat for fish and macroinvertebrates was limited to macrophytes and overhanging vegetation. Macrophyte species in the drains included water pepper, water celery, starwort and watercress.

The limited volume of the water in these drains, and their ephemeral nature, greatly limits the instream habitat potential for fish, however it is not impossible that mudfish could have persisted in these drains when water is present.

These drains ranged from 0.2 m to 1 m in width, averaging approximately 0.75 m wide. Both drains run through wetland habitat in their lower reaches and therefore are provided some shading from overhanging rushes (predominantly *Juncus* spp.), however this is limited.

Overall, these drains were assigned a **negligible** ecological value.



Photo 16. The upper portions of Drain 3



Photo 17. The upper portions of Drain 3



Photo 18. Drain 4



Photo 19. Location of Drain 4 under gorse and blackberry

5.5.3.5 Other drains

Other drains within the site included six short (up to 50 m) drains constructed to convey water from the adjacent wetlands into Watercourse 1, constructed between 1973 and 1986.

All of these drains are shallow and only occasionally convey water. Like Drains 3 and 4, when water is present, water quality within these drains is poor and they are unlikely to support any native fish species, however there is a very low chance that they could support brown mudfish.

Overall, these drains were assigned a **negligible** ecological value.

5.5.4 Wetlands

The site contains a number of natural in wetland systems which would have most likely originally been separated by the dune system. As described earlier, the wetland system in the northern portion of the site was cleared of vegetation in 2018, and most likely at that time also had drains installed. Consequently, its extent is greatly reduced from what was initially present. South of the dune system, wetlands are present on both sides of Watercourse 1. These wetlands have been grouped into clusters based upon their features such as saturation and vegetation types.

As described in Section 4.1; these wetlands would likely have historically been vegetated with kahikatea-dominated swamp forest, which would have graded into wetland carr habitat near open water areas; with localised mānuka-dominated fen habitats also present. However, owing to the site's agricultural history, all wetlands within the site have been cleared of original vegetation and are classified as 'Exotic Wetlands' as they are heavily dominated by exotic species, including water pepper (FACW), Mercer grass (*Paspalum distichum*; FACW) and creeping bent (*Agrostis stolonifera*; FACW).

Localised incidences of native species occurred throughout the site, including native willow weed (*Persicaria decipiens*; OBL), wīwī (*Juncus edgariae*; FACW), *Isolepis prolifera* (OBL) as well as an isolated sward of rautahi/cutty grass (*Carex geminata*; FACW) in the south of Wetland 7. All wetlands within the site were dominated by FACW and/or OBL plant species, and consequently were identified using the rapid test; however, one vegetation plot was utilised to confirm if one portion of Wetland 7 met the criteria to be considered part of that wetland. All wetlands contained just one herbaceous vegetative tier, limiting habitat complexity within the wetlands.

All wetlands are 'palustrine'; and would most likely have all originally been fens, however increased nutrient inputs have led to the development of more 'swamp-like' characteristics. None of the wetlands have obvious

inflows, and it is most likely that the primary driver for the formation of the site's wetlands is the high groundwater table, with inputs from localised surface runoff and rainfall. Refer further assessment of the hydrological characteristics of the site in the Hydrology Assessment.

All wetlands within the site are heavily impacted by historic and ongoing stock access and grazing, which has led to pugging, vegetation modification and reduced water quality. Heavy grazing from Canada geese was also occurring in localised areas of wetlands and on the wetland edges. None of the wetlands have an effective riparian buffer; and were primarily surrounded by grassland or exotic scrubland.

Due to the predominantly exotic vegetation, which is dominated by non-fruiting, wind dispersed plant species, and the low-growing, singular vegetative tier, the ability of the wetlands to provide food or shelter for native terrestrial fauna is limited, although they may occasionally be visited by bird species for foraging.

Water levels within the wetlands are mostly limited to saturated soils, although in some areas, open water or shallow standing water was present during the first site visits (May 2023), which may provide temporary habitat for some fish species, including shortfin eel. During the later site visit, accompanied by GWRC (May 2024), all of the wetlands were completely dry, with no damp ground or standing water.

Specific features pertaining to individual wetlands or wetland clusters is described in Sections 5.5.4.1 to 5.5.4.9. Section 5.5.4.10 then summarises the ecological value of each of the wetlands.

5.5.4.1 Wetland 1

Wetland 1 is a 510 m^2 palustrine wetland located to the north of Watercourse 1 (Photo 20 and Photo 21). It has no inlet or outlet, and is therefore not connected to any of the other waterbodies on site. It is located within a small depression.

Due to the shallow nature of the wetland, and its small size, it is only intermittently saturated. The wetland is dominated by water pepper (FACW). Other species present included wetted pasture species, Mercer grass (*Paspalum distichum*; FACW) and creeping bent (*Agrostis stolonifera*; FACW), buttercup (*Ranunculus repens*; FAC), and dock (*Rumex obtusifolius*, FAC).

The wetland contains one hydrological unit, which is the intermittently saturated soil with no standing water. It is highly unlikely the wetland would provide habitat for native fish species, but may provide foraging habitat for native birds.



Photo 20. Example of vegetation in Wetland 1



Photo 21. Example of vegetation in Wetland 1

5.5.4.2 Wetland 2

Wetland 2 is a 5,233 m^2 palustrine wetland located to the north of Watercourse 1, and north-east of Wetland 1 (Photo 22 to Photo 25). It has no inflows; and drains into Watercourse 1 via an artificial drain. It is located in a depression and is bounded to the north by the dune system.

The wetland was saturated at the northern edge which abuts the dunes (May 2023), but dries out periodically (May 2024), with intermittently saturated edges. The wetland is dominated by wetted pasture species, mercer grass and creeping bent in the wetter portions, and water pepper in the intermittently saturated portions. Also present throughout are rushes, including soft rush (*Juncus effusus*; FACW), wīwī (*J. edgariae*; FACW) and broom rush (*J. sarophorus*; FACW), buttercup and dock.

When saturated, the wetland contains two hydrological units, which are the intermittently saturated areas with no standing water, and then the more saturated areas which included a mosaic of shallow (up to 0.5 m in depth) open water areas present at the time of the first site visit. The wetland may provide habitat for birds and temporary habitat for native fish (e.g., shortfin eels).



Photo 22. Elevated view of Wetland 2, facing south. Also visible is Wetland 4 (far left) and Wetland 1 (beyond Wetland 2); as well as the Wharemaukū Stream (solid blue line, and Watercourse 1 (dashed blue line).



Photo 23. Example of vegetation in drier areas of Wetland 2



Photo 24. Example of vegetation in wetter areas of Wetland 2



Photo 25. Example of mosaic open water areas in Wetland 2 in May 2023.

5.5.4.3 Wetland 3

Wetland 3 is a 6,714 m^2 palustrine wetland located to the north of Watercourse 1, and north-east of Wetland 2 (Photo 26 to Photo 28). It has no inflows; and drains into Watercourse 1 via three artificial drains. Like Wetlands 1 and 2, it is located in a depression, however it is situated a greater distance from the dune system than Wetland 2.

Like Wetland 2, Wetland 3 is also a mosaic of areas that are likely saturated for part of the year and areas that are only occasionally saturated, with open water occurring during the wetter times of the year. Vegetation cover was very similar to that observed in Wetland 2; and like Wetland 2, Wetland 3 may also provide habitat for both native fish (e.g., shortfin eels) and birds.



Photo 26. Example of vegetation in Wetland 3



Photo 27. Example of vegetation in Wetland 3, also showing pockets of open water in May 2023.



Photo 28. Elevated view over Wetland 3

5.5.4.4 Wetland 4

Wetland 4 is a 13,407 m^2 palustrine wetland complex located to the south of Watercourse 1, and to the south-west of Wetland 5 (Photo 29 to Photo 32). It has no inflows; and drains into Watercourse 1 via an artificial drain. It is located in a series of depressions, and like the other wetlands within the site, it is likely to be predominantly groundwater fed.

Like Wetland 2 and 3, Wetland 4 also contains areas that are occasionally fully saturated, and areas that are only damp. When wet, the saturated areas are localised to one large area in the north of the wetland, with the more intermittent areas on the periphery (May 2023).

Vegetation within the wetland was dominated by water pepper and willow weed (*Persicaria maculosa*; FACW) in the intermittently saturated areas, with buttercup, Yorkshire fog (*Holcus lanatus*; FAC) and dock also present. In the wetter areas, vegetation was dominated by broom rush and wīwī, whilst the open water areas in May 2023 contained starwort, water primrose (*Ludwigia palustris*; OBL) and duckweed (*Lemna disperma*; OBL). Mercer grass was also present in the more saturated areas.

Like Wetlands 2 and 3, Wetland 4 may also provide habitat for both native fish (e.g., shortfin eels) and birds.



Photo 29. Open water area within Wetland 4, May 2023

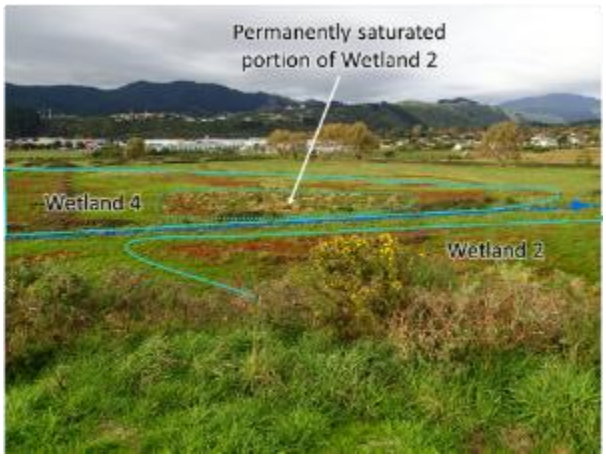


Photo 30. Overview of Wetland 4, showing the permanently saturated portion (May 2023). Wetland 2 and Watercourse 1 are also outlined



Photo 31. Example of vegetation in Wetland 4



Photo 32. Example of vegetation in Wetland 4

5.5.4.5 Wetland 5

Wetland 5 is an 8,279 m^2 palustrine wetland complex located to the south of Watercourse 1, and to the south-west of Wetland 5 (Photo 33 to Photo 36). It has no inflows; and drains into Watercourse 1 via Drain 3 and Drain 4. Like the other wetlands on the site, it is located in localised depressions, and is likely predominantly fed by groundwater.

Wetland 5 is very similar to Wetland 4, in that it contained a central, permanently wet portion (with open water areas) during the May 2023 site visit, with other intermittently wet areas; however, the vegetation composition in the wetter areas varied slightly, with extensive swards of *Isolepis prolifera* (OBL), as well as soft rush and occasional sapling crack willow (*Salix* X *fragilis*; FACW). The wetland was completely dry in May 2024.

Like Wetlands 2, 3 and 4, Wetland 5 may also provide habitat for both native fish (e.g., shortfin eels and birds.



Photo 33. Example of vegetation in Wetland 5



Photo 34. Example of vegetation in Wetland 5



Photo 35. Example of vegetation in Wetland 5



Photo 36. Example of vegetation in Wetland 5

5.5.4.6 Wetland 6

Wetland 6 is a 742 m^2 palustrine wetland located to the east of Wetland 7, immediately south of the dune system (Photo 37 and Photo 38). It has no inflows and outflows, and is therefore not connected to any other water bodies on site.

It contained one predominant hydrological unit, a mostly saturated wetland. A small (< 2 m^2) area of open water was present in the centre of the wetland in May 2023. The vegetation was dominated by soft rush, but also included jointed rush (*Juncus articulatus*; FACW), buttercup, water pepper, water primrose, mercer grass and creeping bent. This wetland was completely dry in May 2024.

Like other wetlands on the site, Wetland 6 may provide habitat for native birds. However, due to its isolation, it is less likely to provide habitat for native fish.



Photo 37. Example of vegetation in Wetland 6



Photo 38. Example of vegetation in Wetland 6

5.5.4.7 Wetland 7

Wetland 7 is a 13,716 m^2 palustrine wetland located to the east of Wetland 6 (Photo 39 to Photo 42). It has no inflows, however it drains into Wetland 5 and then Watercourse 1 via Drain 3. Like the other wetlands on the site, it is located in a localised depression, and is likely predominantly fed by groundwater.

Wetland 7 can be divided into two portions; a smaller northern arm which extends toward Wetland 6, and a larger portion to the south. Vegetation was different in the two portions; with the northern arm including buttercup, *Isolepis prolifera*, Yorkshire fog, wīwī, mercer grass, willow weed, tall fescue (*Lolium arundinaceum*; FAC), umbrella sedge (*Cyperus eragrostis*; FACW), Yorkshire fog, starwort, broom rush and soft rush.

The larger southern portion of the wetland was the only wetland area where a vegetation plot was utilised to determine if the vegetation was wetland vegetation or not (Table 9). Although dominated by tall fescue grass (*Lolium arundinaceum*), the dominance test results (100 %) and the prevalence index score (2.91) both indicated that this area was a wetland. In addition to these results, the area was found to contain numerous open channels between the clumps of grass. The vegetation species listed in Table 9 are largely representative of the vegetation cover over this portion of the wetland, however at the southern end was a patch of rautahi/cutty grass, and there were also patches of blackberry (FAC) throughout.

Like other wetlands on site, Wetland 7 may also provide occasional habitat for both native fish (e.g., shortfin eels) and birds.

Table 9. Vegetation plot results for the plot undertaken to confirm the extent of Wetland 7

Scientific Name	Common Name	Biostatus	Wetland Rating	Coverage (%)	Dominant Species
Paspalum dilatatum	Paspalum	Exotic	FACU	2	
Ranunculus repens	Creeping buttercup	Exotic	FAC	10	
Lolium arundinaceum	Tall fescue	Exotic	FAC	66	Yes
Juncus sarophorus	-	Non-Endemic	FACW	8	
Holcus lanatus	Yorkshire fog	Exotic	FAC	10	
Lotus pedunculatus	Lotus	Exotic	FAC	1	
Agrostis stolonifera	Creeping bent	Exotic	FACW	1	
Juncus effusus	Soft rush	Exotic	FACW	2	
Total coverage				100	



Photo 39. Wetland 7, photographed from the north, facing south



Photo 40. Example of vegetation in Wetland 7



Photo 41. Carex geminata swards within Wetland 7



Photo 42. Open water area within Wetland 7

5.5.4.8 Wetland 8

Wetland 8 is a 3,170 m^2 palustrine wetland located to the east of Watercourse 1, in the northern portion of the site (Photo 43 to Photo 46). As described earlier, this wetland is the remnants of a once larger mānuka-dominated fen, which underwent significant vegetation clearance in 2018.

The wetland is now localised around a network of drains where the larger fen once was. There is however no obvious outlet to this drainage network, so it is not known if the wetland is actively drained. The wetland is intermittently saturated.

Vegetation present within the wetland included water pepper and willow weed, *Isolepis prolifera*, soft rush, jointed rush, buttercup, starwort, water primrose and creeping bent.

It is highly unlikely the wetland would provide habitat for native fish species, due to the extensive recent clearance activities, the limited extent of the wetland, and the limited connectivity to other waterbodies within the site, but it may provide foraging habitat for native birds.



Photo 43. Example of a deeper section of drain within Wetland 8



Photo 44. Example of a shallower section of drain within Wetland 8



Photo 45. Example of a deeper section of drain within Wetland 8



Photo 46. Example of a deeper section of drain within Wetland 8, which has been overgrown with Isolepis prolifera

5.5.4.9 Wetland 9

Wetland 9 is a 1600 m^2 palustrine wetland located to the south of the Whakamaukū Stream, immediately west of Ihakara Street (Photo 47 and Photo 48). It has no inflows and outflows, and is therefore not connected to any other water bodies on site.

The wetland contains one hydrological unit, which is the intermittently saturated soil with no standing water. The vegetation was dominated by soft rush and Yorkshire fog, with buttercup, and if actively farmed would have likely met the pasture exclusion criteria because of the prevalence of exotic grass species. The site was a hardstand and laydown area for the motorway works and was completely cleared of vegetation 2022 (Photo 49 and Photo 50). It is highly unlikely the wetland would provide habitat for native fish species, due to its isolation but may provide foraging habitat for native birds.



Photo 47. Example of vegetation in Wetland 9



Photo 48. Wetland 9 view towards main site.



Photo 49. Wetland 9 site cleared of vegetation June 22



Photo 50. Hardstand area on Wetland 9 site (Google Earth current default imagery).

5.5.4.10 Wetland summary and ecological value

Table 10 summarises the key features of the wetlands on site and provides an ecological value for each wetland.

Table 10. Habitat summary and ecological values of the wetlands present on site.

Attribute	Assessment Criteria or Measurement unit	Wetland								
		Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5	Wetland 6	Wetland 7	Wetland 8	Wetland 9
Vegetation – Native species richness	Proportion of native species counted during site visit	Very low (<10%)	Very low (<10%)	Very low (<10%)	Very low (<10%)	Very low (<10%)	Very low (<10%)	Very low (<10%)	Very low (<10%)	Very low (<10%)
Vegetation - Dominant	Percentage of plant cover that is exotic	Very high (>90%)	Very high (>90%)	Very high (>90%)	Very high (>90%)	Very high (>90%)	Very high (>90%)	Very high (>90%)	Very high (>90%)	Very high (>90%)
Structural tiers	Number of vegetative tiers	1	1	1	1	1	1	1	1	1
Hydrology	Desktop & Site inspections	Intermittent	Intermittent	Intermittent	Intermittent	Intermittent	Intermittent	Intermittent	Intermittent	Intermittent
Number of hydrological units present	Count undertaken during site assessment in May 2023	1 (intermittent wetland)	3 (mostly permanently saturated, mostly intermittently saturated, occasionally open water)	3 (mostly permanently saturated, mostly intermittently saturated, occasionally open water)	3 (mostly permanently saturated, mostly intermittently saturated, occasionally open water))	3 (mostly permanently saturated, mostly intermittently saturated, occasionally open water))	1 (usually permanently saturated areas)	1 (intermittently saturated areas)	1 (intermittently saturated areas)	1 (intermittently saturated areas)
Potential for native aquatic fauna	Assessment from hydrology	Very Low	Moderate	Moderate	Moderate	Moderate	Low	Low	Very Low	Very Low
Wetland Hydrosystem	Johnson & Gerbeaux (2004)	Palustrine	Palustrine	Palustrine	Palustrine	Palustrine	Palustrine	Palustrine	Palustrine	Palustrine
Wetland vegetation type	Classified in accordance with Singers & Rogers (2014).	Exotic wetland	Exotic wetland	Exotic wetland	Exotic wetland	Exotic wetland	Exotic wetland	Exotic wetland	Exotic wetland	Exotic wetland
Size	m^2	510 m^2	5,233 m^2	6,714 m^2	13,407 m^2	8,279 m^2	742 m^2	13,716 m^2	3,170m^2	1,600m^2

Area to perimeter ratio	Ratio of the area to the length of perimeter not contiguous with a native/natural habitat	4.0	10.0	9.0	7.2	7.1	6.6	21.7	2.9	2.9
Potential for enhancement	Site assessment	Low – could be fenced to prevent stock access with a vegetated buffer, and be replanted. However, would still lack connectivity to other contiguous habitats.	Moderate – could be fenced to prevent stock access with a vegetated buffer, and be replanted. However, hydrology would be permanently affected unless the outflowing drain was blocked.	Moderate – could be fenced to prevent stock access with a vegetated buffer, and be replanted. However, hydrology would be permanently affected unless the outflowing drains were blocked.	Moderate – could be fenced to prevent stock access with a vegetated buffer, and be replanted. However, hydrology would be permanently affected unless the outflowing drain was blocked.	Moderate – could be fenced to prevent stock access with a vegetated buffer, and be replanted. However, hydrology would be permanently affected unless the outflowing drains were blocked.	Low – could be fenced to prevent stock access with a vegetated buffer, and be replanted. However, would still lack connectivity to other contiguous habitats.	Low – could be fenced to prevent stock access with a vegetated buffer, and be replanted. However mostly disconnected and dominate by FAC vegetation.	Low – could be fenced to prevent stock access with a vegetated buffer, and be replanted. However, would still lack connectivity to other contiguous habitats.	Low – could be replanted, however, would still lack connectivity to other contiguous habitats.
Ecological value	Site assessment & comparison to EIANZ guideline criteria.	**Low**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Low**	**Low**	**Low**	**Low**

5.6 Ecological Value Summary

Table 11 summarises the ecological values of the habitats and species identified within and surrounding the site.

Table 11. Summary of ecological values of habitats and species within and surrounding the site.

Grouping	Species or habitat	Ecological value
Terrestrial Habitat	Exotic grassland	Negligible
	Exotic scrubland	Low
Freshwater Habitat	Wharemaukū Stream	Moderate
	Watercourse 1	Negligible (upper reaches) and Low (in lower reaches near Wharemaukū Stream).
	Drain 1	Negligible
	Drain 2	Negligible
	Drain 3	Negligible
	Drain 4	Negligible
Wetland Habitat	Wetland 1	Low
	Wetland 2	Moderate
	Wetland 3	Moderate
	Wetland 4	Moderate
	Wetland 5	Moderate
	Wetland 6	Low
	Wetland 7	Low
	Wetland 8	Low
	Wetland 9	Low
Fauna	Native fish	Moderate
	Avifauna	Moderate
	Herpetofauna	Moderate
	Bats	Negligible, not considered further.

6 ASSESSMENT OF ECOLOGICAL EFFECTS

6.1 Assessment Guidance

This section focuses on assessing project-related effects on terrestrial and freshwater ecological values. The assessment is based on the Ecological Impact Assessment Guidelines (EcIAG) produced by the Environment Institute of Australia and New Zealand (EIANZ; Roper-Lindsay *et al*., 2018) and adapted based on expert opinion.

Using this standard framework and matrix approach to determine ecological value (Step 1), determine magnitude of effect in the absence of mitigation/ compensation (Step 2), and assign a level of effect of the project on ecological values (Step 3), is good practice and provides a consistent and transparent assessment of effects. Avoidance, remediation, mitigation, offsetting, and compensatory measures to address potential effects are explored under Step 3 and following the application of such measures an overall level of effects of the project on ecological values is determined.

Two key objectives of the Natural Resources Plan for the Wellington Region 2022 (the NRP) are objectives O25 and O35. Objective O25 aims to safeguard biodiversity, aquatic ecosystem health and mahinga kai in freshwater bodies and the coastal marine area. Objective O35 aims to protect ecosystems and habitats with significant biodiversity values from adverse effects of use and development and, where appropriate, restore then to a healthy functioning state (GWRC, 2022).

GWRC provides guidance to implementing the effects management hierarchy in the NRP, including the Effects Management Hierarchy, and guidance if residual adverse effects on biodiversity remain after the first steps (avoid, minimise, remedy) have been taken, through biodiversity offsets (GWRC, 2022). The guidance document, *Managing adverse effects on indigenous biodiversity in the Wellington Region. A guide to implementing the effects management hierarchy in the Natural Resources Plan* (GWRC, 2022) defines biodiversity offset as:

> *A measurable positive environmental outcome resulting from actions designed to redress the residual adverse effects on biodiversity arising from activities after appropriate avoidance, minimisation, and remediation measures have been applied. The goal of a biodiversity offset is to achieve no net loss, and preferably a net gain, of indigenous biodiversity values. The principles to be applied when proposing and considering biodiversity offsets are provided in Schedule G2 (biodiversity offsetting)*

6.2 Proposed Works

The proposed works will involve completion of bulk earthworks across the entirety of the site; which will result in the permanent, and complete loss of existing freshwater, wetland and terrestrial habitat within the site boundaries. This includes Wetland 8, which is mostly located on 15 Ngahina Street, and owned by Kapiti District Council. The Ivar Trask Road extension into to the site will only result in the loss of the edge of the Wetland 8, but the entire site is included in the assessment as being earthworked (refer to Envelope Engineering Plans, Project 1942-01 Drawing No. 300 – 305).

Watercourse 1 running through the centre of the site will be piped in the upstream section, to allow for access into the site in accordance with the spine road illustrated on the Metropolitian Centre Zone Structure Plan. The remaining downstream length will be diverted into an open swale with planted embankments, maintaining connection between the upper catchment and the Wharemaukū Stream.

The Wharemaukū Stream which has historically been straightened and diverted, will be retained in its current alignment but will be naturalised. Two culverts are also proposed over the stream.

Specific impacts of these proposed works to habitats and fauna are described in the subsections below.

6.3 Effects to Freshwater Habitats

The loss and diversion of the wetlands, watercourses and flow paths will result in actual and potential ecological effects of:

- Loss or degradation of freshwater habitats;
- Death and injury to freshwater fauna;
- Sedimentation; and
- Loss of freshwater connectivity.

6.3.1 Reduction in freshwater habitats

6.3.1.1 Watercourses

The proposed works will result in the removal of Drains 1-4, the partial loss of the upper reaches of Watercourse 1, and the loss of any fauna present within these habitats at the time of clearance. Direct impacts to the Wharemaukū Stream have been minimised, in which no diversion or reclamation is proposed, however stream works to facilitate stream crossings and earthworks within close proximity to the stream will occur.

Approximately 290 m of Watercourse 1 is proposed to be piped, on its upper extent. The remaining 550 m of Watercourse 1 will be realigned through the site, which, in which 300 m will flow through an open swale, and the remaining 250 m will discharge and flow through a constructed biodiversity wetland on the western portion of the site. As Watercourse 1 is an artificial watercourse, this reclamation, diversion and transition to wetland habitat does not constitute the loss of stream extent, however low value aquatic habitat is present within the watercourse. The piping of the upper 290 m of Watercourse 1 is calculated to be of **High** magnitude of effect and the diversion of the lower 550 m of Watercourse 1 is of **Moderate** magnitude, whilst the removal of Drains 1-4 is of **Very High** magnitude due to the proportion of habitat lost.

In addition to the piping and removal of 290 m of Watercourse 1 and the artificial drains, earthworks and vegetation removal will occur throughout the site, including within 8 m of the Wharemaukū Stream. Whilst direct impacts, such as stream reclamation or modification via diversion has been avoided, works adjacent to the stream may degrade ecological values through the reduction of low-value buffering, riparian vegetation. The proposed works within close proximity to the Wharemaukū Stream and its vegetated buffers was considered to be of **Moderate** magnitude.

6.3.1.2 Wetlands

The proposed works will result in the total loss of all wetlands within the site, resulting in the cumulative reduction of 5.33 ha of degraded and modified wetland habitats. The primary ecological values of wetlands are as “the kidneys” of the aquatic ecosystem, providing filtration and improvements in water quality in water from the catchment; and, similarly to streams, the provision of habitat for plants and animals adapted to wet conditions. The majority of wetlands within the site are degraded wetlands which have been modified for agricultural purposes and are dominated by exotic vegetation, with low to moderate ecological values with respect to indigenous biodiversity. Nonetheless, the complete loss of 5.33 ha of wetland habitat within the site was considered to be of **Very High** magnitude.

6.3.2 Freshwater Connectivity

Reductions in catchment connectivity has been largely avoided, as the upstream sections of Watercourse 1 discharge from a piped network, and the artificial drains (Drains 1-4) originate within the site in which their entire length will be lost, avoiding the isolation of upstream proportions. The Wharemaukū Stream will retain connectivity with its upstream and downstream reaches.

Two stream crossings are proposed over the Wharemaukū Stream. The proposed stream crossings will consist of box culverts, appropriately sized for fish passage, requiring a minimum of 4 m in width to accommodate the 3 m wide stream channel in the lower reach of the Wharemaukū, and 3 m wide in the narrower upper reach. The culverts are both designed for fish passage.

6.3.3 Freshwater fauna impacts

Whilst the habitat provisions within the drains for indigenous fish is considered to be very low within the wetlands and drains, these freshwater features may provide habitat for shortfin eel. The reclamation and removal of these aquatic habitats has the potential for the loss, mortality and harm to indigenous fauna. Similarly, streamworks for the construction of a crossing over Wharemaukū Stream may cause harm and/or mortality to indigenous fish and large macroinvertebrates.

The magnitude and level of the potential effect on native freshwater fauna is without management is considered to be **High** due to the nature of the activity, extent of habitat loss/alteration, the density and threat status of impacted species, and the ability of fauna to escape the disturbance. There is a high potential for injury or mortality of native freshwater fauna during the streamworks in the absence of controls.

6.3.4 Sedimentation

Earthworks within the site has the potential to generate sediment, which would negatively impact freshwater habitats adjacent to the works areas. The release of excess fine sediment into streams through changing land use is recognised as a major impact on stream health. Increased fine sediment input to aquatic habitats can reduce visual clarity, clog respiratory structures of animals (such as the gills of fish), degrade benthic habitats and may result in burial and suffocation of aquatic biota (Clapcott *et al.,* 2011).

The potential magnitude of sedimentation effects without management to minimise or mitigate adverse impacts is considered to be **High** due to potential adverse impacts to the immediate downstream receiving environment.

6.3.5 Stormwater

Stormwater generated within the site is proposed to be treated prior to discharge into the freshwater catchment. The discharge of stormwater therefore, should not represent a potential pathway for the introduction of contaminants, such as nutrients, heavy metals or suspended solids.

Stormwater treatment will largely be through bioretention rain gardens, although proprietary devices may be used where space constraints require this. Detention and Retention are being provided through various area-specific devices (soak pits, tanks, rainwater reuse etc.). Refer to the Envelope Stormwater Management Plan submitted with the substantive application for further details.

Stormwater discharges will be to swales and the proposed wetland. Discharges to the wetland have been limited to ensure that maintenance of these does not impact the ecological function. All outlets will be provided with a means of protection from scour e.g. riprap, stilling areas etc. Refer to the civil engineering plans submitted with the substantive application.

Considering the level of treatment of stormwater prior to discharge to the freshwater environment, this should not result in the degradation or reduction of freshwater water quality or subsequent habitat quality (such as the loading of fine sediments or proliferation of periphyton). The discharge of stormwater, including the outlets, will have an overall **Low** magnitude of effect to the freshwater environment.

6.3.6 Magnitude of Effect

Table 12 lists the Magnitude of effect and Level of effect of the proposed works to freshwater habitats without the consideration/inclusion of any effects management measures, which may arise from habitat removal, sedimentation, and injury and mortality to native fish.

Table 12. Magnitude of effect and level of effect of the proposed works to freshwater habitats WITHOUT effects management measures

Habitat	Ecological value	Proposed Activity	Magnitude of effect
Wharemaukū Stream	Moderate	Avoidance, plus culvert crossings	Low
Watercourse 1	Low	Reclamation through piping	High
		Diversion	
Drain 1	Negligible	Reclamation and removal through earthworks and infilling	Very High
Drain 2	Negligible		
Drain 3	Negligible		
Drain 4	Negligible		
Wetland 1	Low		
Wetland 2	Moderate		
Wetland 3	Moderate		
Wetland 4	Moderate		
Wetland 5	Moderate		
Wetland 6	Low		
Wetland 7	Low		
Wetland 8	Low		
Wetland 9	Low		
Native fish	Moderate	Potential harm and/or mortality,	High
		Reductions in connectivity and fish passage	Moderate

6.3.7 Level of effect and effects management

6.3.7.1 Proposed effects management for wetland loss

The proposed wetland loss will result in an overall very high magnitude of effect. Wetland reclamation cannot be avoided, minimised or remediated, resulting in moderate to high level of effect, in which the residual level of effect must be offset or compensated.

Stream loss has been avoided.

It is proposed that the loss of wetland habitat within the site is offset through the ecological enhancement and creation of up to 5.44 ha of wetland habitat and areas of open water provided by Watercourse 1. The wetlands would merge into a riparian buffer of the Wharemaukū Stream, and will be planted with native, ecologically appropriate species which would in time grow to recreate naturally occurring habitats within the project area such as kahikatea-pukatea forest, mānuka fen and reedland habitats and wetland carr areas. The enhancements to the Wharemaukū Stream do not form part of the effect management strategy for wetlands, however will be connected via riparian planting due to the vicinity to each waterbody.

The ecologically-relevant design aspects and ongoing management measures for this wetland and stream system is detailed in the Ecological Management Plan, where a site-specific Freshwater Restoration Plan, has been prepared by a suitably qualified ecologist. This plan includes:

- Recommendations on stream features to be incorporated into the design such as varying hydrological units and microhabitats (e.g. creation of riffles and pools, placement of logs and large rocks instream);
- Recommendations on creation of varying wetland hydrological units (open water/ permanently saturated and intermittently saturated areas);
- Planting specifications for the wetland areas and a terrestrial riparian buffer; and
- Ongoing weed and pest animal management measures. Weed and pest mammal management should be implemented in accordance with the Greater Wellington Regional Pest Management Plan, using best practice methods.

The provision of varied wetland habitats, with multiple structural tiers, different hydrological units and a complex mosaic of wetland types, all linked to a restored and enhanced stream system will provide for high-quality habitats for a variety of native fish, native birds and over time potentially native bats. The wetlands habitats would be hydrologically linked to the stream, ensuring sustained hydrology, and aquatic connectivity to adjacent habitats, including the coast, and complex ecosystems able to support threatened and at-risk fauna, including diadromous native fish.

In addition, the wetlands currently present within the site are limited in their ability to treat and store water, as their vegetation is compromised by both the large proportion of exotic, wet-adapted pasture species and the historic and current grazing of the site, which has greatly reduced and modified the wetland plant biomass and likely soil structure. The creation of native, natural and representative wetland habitat will likely lead to an improvement in freshwater water quality downstream of the site, as the ability of the created wetlands to store and filter water will improve as the vegetation quality improves, to a point where they provide significant water storage and filtration capacity; most likely surpassing the existing ability of the wetlands currently present on site.

6.3.7.2 Proposed effects management for freshwater fauna

Potential adverse effects on freshwater fauna can be minimised through timing of the stream and wetland works, and native fish (and potentially kōura (freshwater crayfish) and kākahi (freshwater mussels)) recovery and relocation immediately prior to streamworks. The Native Freshwater Fauna Salvage and Relocation Plan (NFFSRP) has been prepared within the Ecological Management Plan, and includes, at a minimum, methods to capture fish, measures to prevent fish re-entering the reach, fishing efforts, relocation sites, storage and transportation to prevent stress and death/predation. Prior to any stream works or wetland works commencing, the Native Freshwater Fauna Salvage and Relocation Plan should be submitted to GWRC for certification.

Fish management will be implemented within one week prior to streamworks/reclamation, subject to construction methodology, minimising the potential harm, mortality and injury to indigenous fish. Implementation of native fish recovery protocols prior to impacts to freshwater habitats, will reduce the magnitude of effect on freshwater fauna to **Low**, resulting in an overall **Low** level of effect.

6.3.7.3 Proposed effects management for sedimentation

Works within the site could generate sediment, which would negatively impact freshwater habitats adjacent to the site which will not be fully reclaimed, such as the downstream reaches of Watercourse 1 and stream habitats adjacent to the crossing proposed over Wharemaukū Stream. To minimise the potential for excess fine sediment entering the catchment, an erosion and sediment control plan (ESCP) and Streamworks Management Plan (SMP) should be prepared and implemented by an appropriately qualified person/s using industry best practice. The plan should include methods to manage sediment in discharges of water, as well as dust. No works should occur without ESCP or SMP recommendations being in place. With regard to protection of aquatic health, maintenance and management of the controls adjacent to the streams should be stringent, with erosion and sediment controls checked prior to and immediately following heavy rain events to minimise the potential for failure and sedimentation of the downstream receiving environment.

The potential adverse effects of sedimentation will be limited both in time and magnitude. Erosion, and the consequent mobilisation of sediment will primarily occur during the initial stages of the development during earthworks and streamworks. The implementation of the ESCP and SMP will appropriately minimise and mitigate potential adverse impacts to the ecological values within the site. The magnitude of effect will be **Low,** resulting in an overall **Very Low** to **Low** level of effect**.**

6.3.7.4 Proposed effects management for freshwater connectivity through the site

The freshwater connectivity through the site will be maintained and enhanced through the restoration and naturalisation of the Wharemaukū Stream, provision of fish friendly culverts, and the diversion of the primary drain (Watercourse 1) running through the site (refer Envelope Engineering Drawing No 340). This will maintain the freshwater connections both from north to south and from east to west through the site and allow for improved habitat and connection between the upper Wharemaukū Stream to the coast by providing a 6.6 ha area of diverse protected aquatic and terrestrial habitats.

6.3.7.5 Proposed stream enhancements

The Wharemaukū Stream is proposed to undergo stream enhancements alongside its current alignment, increasing the overall habitat provisions of indigenous freshwater fish and invertebrates, and the ecological function and value of the watercourse.

It is proposed to undertake habitat creation and enhancement through the restoration of the riparian margin with a variety of species which form the early stages in a succession towards a native forest habitat. The restoration planting shall provide aquatic ecological benefits provided by replacing pasture grass and/or weed species with native shrubs and trees in the riparian zone, providing temperature control and reduction of nuisance growth of aquatic vegetation through shading; woody debris and leafy inputs to the stream, increasing habitat, food and refuges for invertebrates and fish. Furthermore, the riparian planting will provide stabilisation of channel banks and channel shape; and reduction of nutrient and sediment inputs into the streams. The riparian planting has been carefully designed to provide for robust, disturbance tolerant and responsive native species on the true left bank (southern bank), such as cutty grass, to allow for maintenance to occur; with larger, less disturbance tolerance species included on the true right bank.

In addition to planting of the riparian area, stream enhancement/restoration actions are proposed within and adjacent to the stream, at appropriate intervals. The enhancements would be a 'tool box' (Figure 20, Appendix 7) of measures, which include:

- boulders to create variability in the hydrology and habitat;
- slight widening of the channel to create shallow cobble to create habitat for macroinvertebrate and for fish spawning;
- root wads or large wood for habitat creation;
- shallow pools to create variation in depths and hydrology;
- patches of trees and shrubs with strong fibrous roots planted very close to the water's edge, increasing connection between the stream and the land, and resulting in in-stream roots and protected bank habitat for fish and macroinvertebrates.

The majority of stream enhancements would occur on the true right bank, adjacent to the new wetland, but with clear patches of enhancements on the true left bank, that can be worked around when the channel maintenance is required. The flood maintenance requirement should include provision for ensuring an uneven profile is left in the stream channel, with emphasis on leaving small pools and riffles prior to departure. (Figure 21, Figure 22)

Provided the aforementioned stream enhancement actions are adhered to and implemented, the enhancements of the Wharemaukū Stream will result in an overall **Positive** level of effect as the quality and quantity of indigenous habitats, and the effectiveness of the riparian buffers and subsequent stream benefits, will be increased.

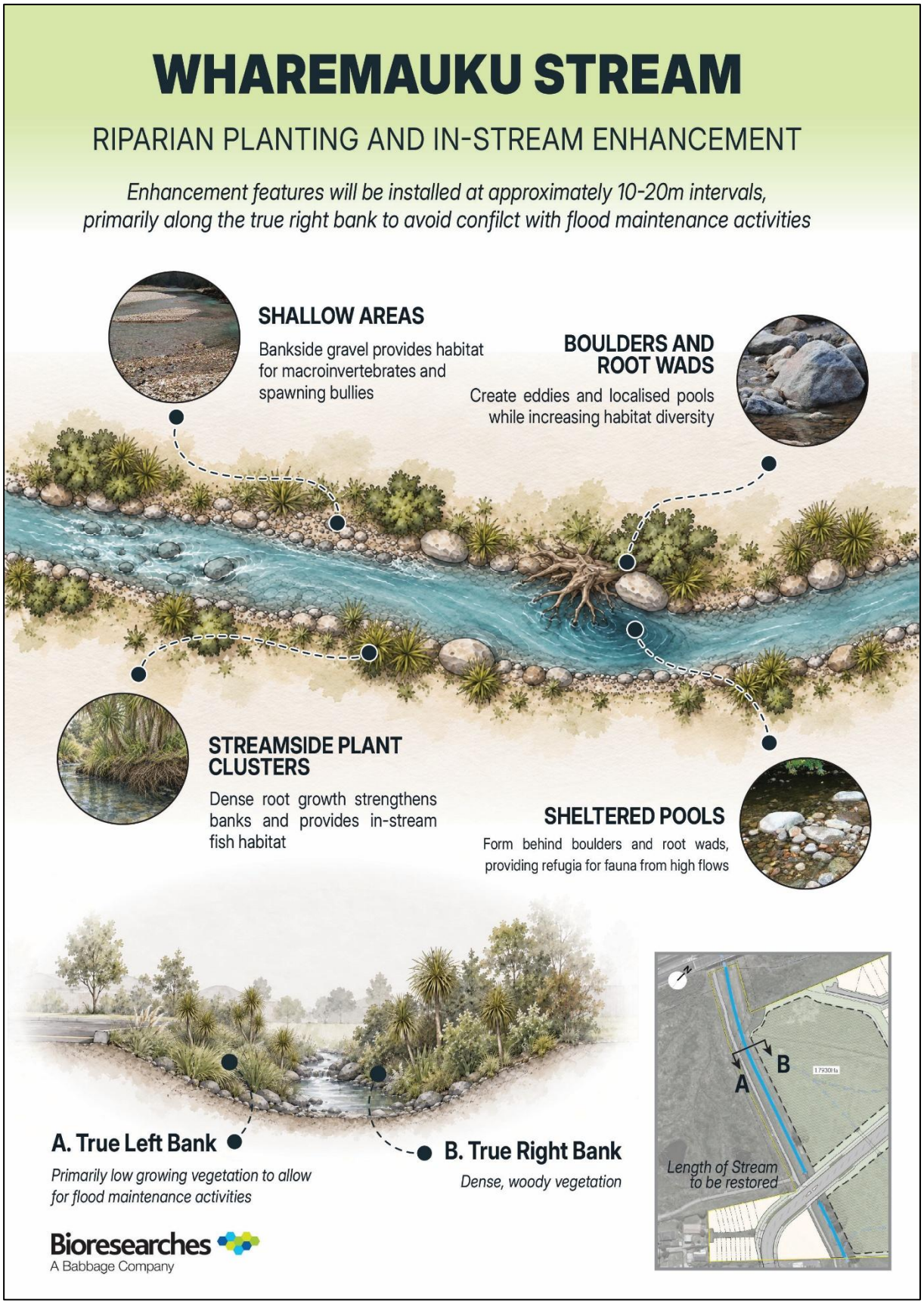


Figure 20: Diagram showing in-stream enhancements proposed along the Wharemaukū Stream



Figure 21: Diagram showing softer planting on true left bank adjacent to roadside to allow for flood maintenance; and denser, woodier planting on the true right bank where flood maintenance access is not required

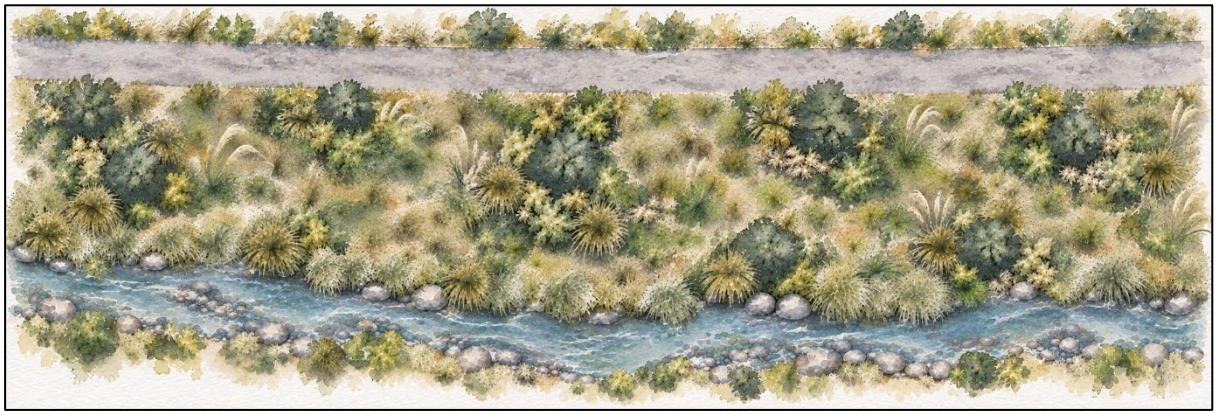


Figure 22: Along the True Left Bank, clusters of taller planting occur at approximately 45% density between areas of lower growing grasses to allow for flood maintenance activities.

6.4 Terrestrial habitats and fauna

6.4.1 Terrestrial habitats and botanic loss

The complete loss of the exotic grassland and exotic scrubland habitats within the site will be a high magnitude of effect due to the complete loss of these habitats and vegetation communities. This will lead to a **Very Low** level of effect for the exotic grassland habitat, and a **Low** level of effect for the exotic scrubland habitat.

6.4.2 Avifauna

The proposed works have the potential to disturb native birds utilising the 'exotic grassland', 'exotic scrubland' and the wetland habitats on site. There are two effects which will potentially affect birds as a result of this:

- Loss of habitat; and
- Potential for injury and/or mortality to birds during the habitat clearance.

Clearance of the site will reduce the availability of habitat for a range of native bird species. However, the habitat is considered to be of negligible or low value for any species other than 'Not Threatened' species, with the exception of the 'At Risk' pipit which may nest in the site. However, within the general vicinity of the site are many areas of similar habitat which would also support these birds, and therefore this is not considered to be a complete loss of habitat for these species, although it will be permanently removed.

Adult birds are likely able to relocate themselves during habitat removal, however, chicks and eggs are at risk of injury or death during vegetation removal activities, as they are not able to relocate themselves.

Consequently, the magnitude of effect of the loss of this habitat and the associated potential for injury or death to native birds is considered to be **High**, which would lead to a **Moderate** level of effect to birds without effects management.

6.4.3 Herpetofauna

The proposed works have the potential to disturb native skinks utilising the exotic scrubland habitat on site. There are two effects which will potentially effect lizards as a result of this:

- Loss of habitat; and
- Potential for injury to lizards during the habitat clearance.

Without effects management measures in place, the works could result in the complete loss of a lizard population within the site. Without mitigation, this would have a **Very High** magnitude of effect, which would lead to a **High** level of effect to lizards. Consequently, effects management for lizards would be required. This is described below.

6.4.4 Bats

Bats are highly unlikely to be present on the site, and therefore no effects are expected.

6.4.5 Magnitude of Effect

Table 12 lists the Magnitude of effect and Level of effect of the proposed works to freshwater habitats without the consideration/inclusion of any effects management measures, which may arise from habitat removal, sedimentation, and injury and mortality to native fish.

Table 13. Magnitude of effect and level of effect of the proposed works to terrestrial habitats and fauna WITHOUT effects management measures

Habitat	Ecological value	Magnitude of effect	Level of Effect
Exotic grassland	Negligible	High	Very Low
Exotic scrubland	Low	High	Low
Avifauna	Moderate	High	Moderate
Herpetofauna	Moderate	Very High	High
Bats	Negligible	Negligible	Very Low

6.4.6 Level of effect and effects management

6.4.6.1 Proposed effects management for terrestrial habitat loss

The majority of the ecological value of these habitats lies in the potential provisioning of shelter for native fauna and not in the botanical attributes of these habitats. Effects of the loss of this habitat for fauna are discussed separately below in Section 6.3.

The botanical value of both habitats is considered to be 'very low', as neither habitat is representative of a naturally occurring habitat type within the project area, and both are heavily dominated by exotic species.

It is considered that the 25,000 m^2 of dominantly terrestrial riparian planting proposed along the stream and wetland corridor (as discussed above in Section 6.3), which would eventually mature into kahikatea pukatea forest, once established will have a far greater ecological value than the exotic grassland and exotic scrubland habitat. Exotic grassland habitat will still be represented within close proximity of the site in the public grounds to the east, the Wharemaukū Stream riparian area and airport grounds to the west.

The proposed planting will more than adequately replace the lost botanical value of the exotic grassland and scrubland habitats, as it will incorporate a wide variety of ecologically appropriate native species. In addition, the plantings will be of far greater ecological value for native fauna, providing improved shelter, and a vast increase in the availability of food resources. The habitat will also provide a far greater amount of nesting habitat for native birds. In addition, the implementation of pest control would reduce fauna predation and increase breeding success and recruitment of terrestrial fauna species utilising the habitat. Finally, the connection of the habitat to the wetlands to the south of the site will greatly increase the overall size of contiguous native habitat within the project area.

With this proposed effect management in place, the magnitude of effect of the proposed works is considered to be positive, and after being allowed sufficient time to establish, would lead to a **net gain** in terrestrial ecological value across the site.

6.4.6.2 Proposed effects management for avifauna

To avoid potential mortality or injury to avifauna during the Project works (e.g. mortality to eggs, chicks during vegetation clearance), an Avifauna Management Plan (AMP) has been prepared and will be implemented for all vegetation clearance activities on site that pose risk to native avifauna. The AMP will detail protocols for pre-construction nest-checks, and as required, nest / chick protection and exclusion zones if necessary. The detailed methodology is set out in the AMP with key points described within Section 7.1.3.

The restoration of a portion of the Wharemaukū Stream and subsequent creation of adjacent wetland habitats (as described in Section 7.2) and the planting of such with native species is considered to both adequately replace the loss of habitat and enhance the biodiversity values within the site for avian species.

If the effects management measures detailed in the AMP and the restoration of the Wharemaukū Stream is undertaken, it is considered that the magnitude of effects of the proposed vegetation removal upon birds would be low, resulting in an overall **Low** level of effect. No further effects management measures for birds are required.

6.4.6.3 Proposed effects management for lizards

To avoid potential mortality or injury to lizards during the Project works a Lizard Management Plan (LMP) has been prepared and is proposed to be implemented for all vegetation clearance activities on site. Key protocols as outlined in the LMP are provided in Section 7.1.2 and are intended to achieve the following objectives:

- The population of each species of native lizard present on the site at which vegetation clearance is to occur must be maintained or enhanced, either on the same site or at an appropriate alternative site; and
- The habitat(s) that lizards are transferred to (either on site or at an alternative site, as the case may be) will support viable native lizard populations for all species present pre-development.

The management measures and protocols set out in the LMP are considered sufficient to minimise the risk of mortality or injury to indigenous lizards and to ensure that suitable habitat is retained or provided, either on-site or at an appropriate nearby relocation site, to support displaced individuals. Consequently, the magnitude of effect of the proposed works to lizards would be **Low**, leading to an overall **Low** level of effect to lizards. No additional effects management measures are required.

6.5 Summary of effects

Table 13 summarises effects to the species and habitats described above.

Table 14. Level of effect of the removal of vegetation and aquatic habitats on the relevant species groups or habitats described in Section 6. The level of effect is calculated using the matrix presented in Table 16 and Table 17.

Grouping	Species or habitat	Ecological value	Magnitude of effect	Level of effect prior to effects management	Proposed effects management	Level of effect following effects management undertaken as recommended in this report	Residual Level of effect
Terrestrial Habitat	Exotic grassland	Negligible	High	Very low	Level of effects low and very low, aside from potential fauna management, no mitigation / management required. Significant benefits by planting native trees and shrubs adjacent to restored stream and wetland areas; significant benefits with removal of pest plants.	Positive	Net gain
	Exotic scrubland	Low	High	Low		Positive	Net gain
Freshwater Habitat	Wharemaukū Stream	Moderate	High	Moderate	Stream restoration and enhancement with hydrologic variation, connectivity to wetland habitats, native restoration plantings, removal of fish barriers. Removal of culverts and partial fish barriers within the site.	Positive	Low
	Watercourse 1	Negligible (upper reach) Low (lower reach)	High	Low & very low		Low & very low	Net gain
	Drain 1	Negligible	Very high	Low		Low	Net gain
	Drain 2	Negligible	Very high	Low		Low	Net gain
	Drain 3	Negligible	Very high	Low		Low	Net gain
	Drain 4	Negligible	Very high	Low		Low	Net gain
Wetland Habitat	Wetland 1	Low	Very high	Moderate		Moderate	Net gain
	Wetland 2	Moderate	Very high	High		High	Net gain
	Wetland 3	Moderate	Very high	High		High	Net gain
	Wetland 4	Moderate	Very high	High		High	Net gain
	Wetland 5	Moderate	Very high	High		High	Net gain
	Wetland 6	Low	Very high	Moderate		Moderate	Net gain
	Wetland 7	Low	Very high	Moderate		Moderate	Net gain

	Wetland 8	Low	Very high	Moderate	Effects cannot be minimised or remediated and must be offset or compensated through Wetland creation and wetland restoration. Restoration to include native vegetation, multiple tiers, sustained hydrology; connected to the wider catchment and riparian vegetation. Removal of pest plants.	Moderate	Net gain
	Wetland 9	Low	Very high	Moderate		Moderate	Net gain
Fauna	Avifauna	Moderate	High	Moderate	Implementation of nesting bird surveys prior to vegetation clearance, and management of any nests found.	Low	Low
	Herpetofauna	Moderate	Very high	High	Implementation of lizard management plan	Low	Low
	Bats	Negligible, not considered further.	N/A	N/A	N/A	N/A	N/A
	Native fish	Moderate	High	Moderate	Native fish recovery and relocation from impacted watercourse and wetland habitats	Negligible	Very Low

As the overall level of effect of the proposed activities after the effects management hierarchy has been fully implemented, on each of the relevant species or habitats is low or a net gain, further mitigation measures are not required.

7 SUMMARY AND RECOMMENDATIONS

The project aims to address ecological effects as far as practicable through implementation of the effects management hierarchy and use of best practice principles to guide any necessary effects management measures.

It is not anticipated that the project's adverse effects would result in the loss of or unacceptable disturbance to indigenous species, ecosystems, or critical ecosystem functions on-site nor within the context of the wider landscape. With successful implementation of the proposed ecological enhancement and fauna management measures, the Project is expected to achieve an overall improvement in biodiversity values across terrestrial, wetland and freshwater habitats over time.

Measures to avoid, minimise and remediate adverse ecological effects will be implemented through an Ecological Management Plan (EMP), to be submitted to GWRC and DOC for approval prior to Project works. The EMP will set out protocols and management measures to ensure compliance with the Wildlife Act 1953, Resource Management Act 1991 (RMA), and Fast-track Approvals Act 2024. These measures are contained within the following management plans and described in further detail in the following sections:

- Native Freshwater Fauna Salvage and Relocation Plan;
- Lizard Management Plan;
- Avifauna Management Plan; and

Freshwater Restoration Plan (including wetland and stream planting, and pest control)

To appropriately mitigate for potential adverse effects on native fauna (native fish, birds and lizards; bats are not considered due to the very low likelihood of their occurrence on site) the following recommendations are provided (refer below).

7.1 Management of protected native fauna

7.1.1 Native Freshwater Fauna Salvage and Relocation Plan

Prior to any stream works or wetland works commencing, a Native Freshwater Fauna Salvage and Relocation Plan (NFFSRP) should be prepared and submitted to GWRC for certification. Key details within the NFFSRP include:

i) Fish exclusion barriers and dewatering;

ii) Trapping and/or electrofishing methodologies;

iii) Transport methodology;

iv) Location and description of the translocation site/s;

v) The procedure to humanely euthanise pest fish;

vi) Timing and duration of fish capture in relation to the staging of the stream works and works in connected wetlands; and

vii) Name, experience, qualifications of those involved in undertaking the fish relocations.

7.1.2 Lizard Management Plan

A site-specific LMP has been prepared and will be submitted to GWRC and DOC for certification with details and measures to avoid and mitigate adverse effects on protected native lizards. Lizard management will involve salvaging, relocating, and potentially monitoring relocated native lizards, as well as implementing measures to enhance lizard habitat on-site. Key details within the LMP include:

- Credentials and contact details of the ecologist/herpetologist who will implement the plan;
- Timing of the implementation of the LMP (October to April, inclusive);
- A description of methodology for survey, trapping and relocation of translocated lizards including but not limited to: salvage protocols, relocation protocols (including method used to identify suitable relocation site(s)), diurnal capture protocols, supervised habitat clearance/transfer protocols, artificial cover object protocols, and opportunistic relocation protocols.
- An assessment of appropriate release sites using the key principles for lizard salvage and transfer guidelines (NZLizardTAG 2019);
- A full description of the recommended relocation site(s);
- A description of habitat enhancement measures and triggers e.g. depositing salvaged logs, wood or debris for newly released native skinks that have been rescued, and cobble rock piles for translocated geckos;
- A post-vegetation systematic habitat clearance search for remaining lizards;
- A description for the trigger, management, and protocols for pest plant and animal control; and
- Any monitoring requirements, i.e., surveys to evaluate translocation success (pre and post translocation); and monitoring of pest control efficacy and the resulting impact on lizard populations.

As a Wildlife Act Authority (WAA) is required to capture, handle, and relocate indigenous wildlife, this LMP will only be actioned under a valid Department of Conservation WAA.

7.1.3 Avifauna Management Plan

The objective of the AMP is to avoid mortality and injury and minimise disturbance to nesting indigenous birds that occur on site. The AMP will achieve this objective by applying current best-practice survey and monitoring methods and establishing standard protocols for breeding bird management. Key elements of the AMP include:

- Identification of the suitably qualified ecologist/ornithologist responsible for implementing the plan;
- Timing of the implementation of the AMP;
- Identification of affected habitats and species; and
- Pre-clearance and pre-works nest surveys, nest monitoring, exclusion zones, nest demarcation, and chick management where required. Exclusion distances include 50 m for TAR species and 15m for terrestrial avifauna.

7.2 Ecological enhancement

Freshwater habitats lost within the site will be replaced with a stream and wetland system. The Wetland Residual Effects Analysis Report (REAR-WL, Bioresearches 2026a) provides a summary of the approach, methodologies and analysis used to determine the wetland offset/compensation requirements for the Kapiti Road development. The ecologically relevant design aspects and ongoing management measures for this wetland and stream system will be detailed in a site-specific Freshwater Restoration Plan (FRP), which should be prepared by a suitably qualified ecologist. Key elements of the FRP include:

- Recommendations on stream features to be incorporated into the design such as varying hydrological units and microhabitats (e.g. creation of riffles and pools, placement of logs and large rocks instream);
- Recommendations on creation of varying wetland hydrological units (open water/ permanently saturated and intermittently saturated areas);
- Planting specifications for the wetland areas and a terrestrial riparian buffer; and
- Ongoing weed and pest animal management measures. Weed and pest mammal management should be implemented in accordance with the Greater Wellington Regional Pest Management Plan, using best practice methods.

7.3 Management of freshwater environments

An erosion and sediment control plan (ESCP) should be prepared and implemented by an appropriately qualified person/s using industry best practice. The plan should include methods to manage sediment in discharges of water, as well as dust. No works should occur without ESCP recommendations being in place.

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APPLICABILITY AND LIMITATIONS

Restrictions of Intended Purpose

This report has been prepared solely for the benefit of New Central Park as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such party's sole risk.

Legal Interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

Maps and Images

All maps, plans, and figures included in this report are indicative only and are not to be used or interpreted as engineering drafts. Do not scale any of the maps, plans or figures in this report. Any information shown here on maps, plans and figures should be independently verified on site before taking any action. Sources for map and plan compositions include LINZ Data and Map Services and local council GIS services. For further details regarding any maps, plans or figures in this report, please contact Bioresearches.

Appendices

Appendix 1– Ecological Impact Assessment Methodology

The assessments were undertaken in general accordance with Ecological Impact Assessment guidelines, published by the Environment Institute of Australia and New Zealand (EIANZ; Roper-Lindsay *et al*. 2018). The Guidelines provide criteria for assigning value to habitat for assessment purposes. Values are assigned (High, Moderate, Low, Very Low, Table 15) based on the following four assessment matters (as described in Roper Lyndsay et al. 2018):

1. Representativeness
2. Rarity / Distinctiveness
3. Diversity / Pattern
4. Ecological Context

The level of effect is then determined by determining the magnitude (Table 16) and combining the value of the ecological feature/attribute with the score or rating for magnitude of effect to create a criterion for describing the level of effects (Table 17). The cells in Table 3 italics in represent a 'significant' effect under the EIANZ 2018 guidelines.

Cells with low or very low levels of effect represent low risk to ecological values rather than low ecological values *per se*. A moderate level of effect requires careful assessment and analysis of the individual case. For moderate levels of effects or above, measures are expected to be introduced to avoid through design, or appropriate mitigation needs to be addressed (Roper-Lindsay *et al*. 2018).

Table 15. Criteria for assigning value to habitat/species for assessment.

Value	Determining Factors
Very High	Nationally Threatened species found in the 'zone of influence' (ZOI) either permanently or seasonally. Area rates 'High' for at least three of the assessment matters of Representativeness, Rarity/distinctiveness, Diversity and Pattern, and Ecological Context. Likely to be nationally important and recognised as such.
High	Species listed as At Risk – Declining found in the ZOI either permanently or seasonally. Area rates 'High' for two of the assessment matters, and 'Moderate' and 'Low' for the remainder OR area rates 'High' for one of the assessment matters and 'Moderate' for the remainder. Likely to be regionally significant and recognised as such.
Moderate	Species listed as At Risk – Relict, Naturally Uncommon, Recovering found in the ZOI either permanently or seasonally. Locally uncommon or distinctive species. Area rates 'High' for one of the assessment matters, 'Moderate' or 'Low' for the remainder OR area rates as 'Moderate' for at least two of the assessment matters and 'Low' or 'Very Low' for the remainder. Likely to be important at the level of the Ecological District.
Low	Nationally and locally common indigenous species. Area rates 'Low' or 'Very Low' for majority of assessment matters, and 'Moderate' for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Exotic species including pests, species having recreational value. Area rates 'Very Low' for three assessment matters and 'Moderate', 'Low' or 'Very Low' for the remainder.

Table 16. Criteria for describing the magnitude of effects (EIANZ 2018)

Magnitude	Description
Very High	Total loss of, or a very major alteration to, key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature.
High	Major loss of major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature.
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature.
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances and patterns; AND/OR Having minor effect on the known population or range of the element/feature.
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature.

Table 17. Criteria for describing the level of effects (EIANZ 2018). Where text is italicised, it indicates 'significant effects' where mitigation is required.

Magnitude of Effect	Ecological Value				
	Very High	High	Moderate	Low	Negligible
Very High	*Very High*	*Very High*	*High*	*Moderate*	Low
High	*Very High*	*Very High*	*Moderate*	Low	Very Low
Moderate	*High*	*High*	*Moderate*	Low	Very Low
Low	*Moderate*	Low	Low	Very Low	Very Low
Negligible	Low	Very Low	Very Low	Very Low	Very Low
Positive	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain

Appendix 2 – Plant Species from wetland plots by botanist Pat Enright (Boffa Miskel, 2020)

Cumulative plant list from all wetland plots, their wetland affinity rating, pasture rating, and indigenous status, and additional plants from outside of plots.

Scientific Name	Pasture category	wetland rating	Origins
Agrostis stolonifera	Pasture assoc.	FACW	Exotic
Angallis arvensis	Pasture assoc.	FACU	Exotic
Anthoxantum odoratum	Pasture assoc.	FACU	Exotic
Azolla rubra	Non pasture	OBL	Native
Bidens frondosa	Non pasture	FACW	Exotic
Centella uniflora	Non pasture	FACW	Native
Erigeron sumatrensis	Non pasture	FACU	Exotic
Euchiton involucratus	Non pasture	FAC	Native
Galium palustre	Non pasture	OBL	Exotic
Gonocarpus micranthus	Non pasture	FAC	Native
Holcus Lanatus	Pasture	FAC	Exotic
Hydrocotyle moschata	Non pasture	FACW	Native
Hypochaeris radicata	Pasture assoc.	FACU	Exotic
Isolepis prolifera	Non pasture	OBL	Native
Juncus articulatus	Non pasture	FACW	Exotic
Juncus edgariae	Non pasture	FACW	Native
Juncus effusus	Non pasture	FACW	Exotic
Juncus pallidus	Non pasture	FACW	Native
Juncus planifolius	Non pasture	FACW	Native
Juncus sarophorus	Non pasture	FACW	Native
Lemna disperma	Non pasture	OBL	Native
Leontodon taraxicoides	Pasture assoc.	FAC	Exotic
Lolium multiflorum	Pasture	FAC	Exotic
Lotus pedunculatus	Pasture	FAC	Exotic
Lotus suaveolens	Pasture assoc.	FAC	Exotic
Ludwigia palustris	Non pasture	OBL	Exotic
Lythrum hyssopifolia	Non pasture	FACW	Exotic
Mentha pulegium	Non pasture	FAC	Exotic
Myosotis laxa	Non pasture	OBL	Exotic
Parentucellia viscosa	Pasture assoc.	FACU	Exotic
Paspalum dilatatum	Non pasture	FACU	Exotic
Paspalum distichum	Non pasture	FACW	Exotic
Persicaria hydropiper	Non pasture	FACW	Native
Plantago lanceolata	Pasture	FACU	Exotic
Plantago major	Pasture	FACU	Exotic
Prunella vulgaris	Pasture assoc.	FACU	Exotic
Pseudognaphalium luteoalbum	Pasture assoc.	FACW	Native
Ranunculus repens	Non pasture	FAC	Exotic
Rorippa palustris	Non pasture	OBL	Native

Rubus fruticosus	Non pasture	FACU	Exotic
Rumex crispus	Pasture assoc.	FAC	Exotic
Rumex obtusifolius	Pasture assoc.	FAC	Exotic
Schoenus maschulinus	Non pasture	FACW	Native
Trifolum repens	Pasture	FACU	Exotic
Ulex europaeus	Non pasture	FACU	Exotic
Centipeda cunninghamii	Sneezeweed	Native	
Centipeda elatinoides	Sneezeweed	Native	
Persicaria maculosa	Willow weed	Exotic	
Rumex acetosella	Sheep sorrel	Exotic	
Kunzea ericoides	Kanuka	Native	
Lolium arundinaceum	Tall fescue	Exotic	
Symphotrichium subulatum	Bushy starwort	Exotic	

Appendix 3 – Not-threatened and non-resident avifauna records

Table 18. Not-threatened and non-resident avifauna species found within 5 km of the site

Conservation status	Common name	Scientific name	Record source
Not Threatened	Pied stilt	*Himantopus himantopus leucocephalus*	New Zealand Bird Atlas, iNaturalist
	Australasian shoveler	*Anas rhynchotis*	New Zealand Bird Atlas, iNaturalist
	Shining cuckoo	*pīpīwharauroa / shining cuckoo*	New Zealand Bird Atlas
	kāhu / Australasian harrier	*Circus approximans*	New Zealand Bird Atlas, iNaturalist
	kererū / New Zealand pigeon	*Hemiphaga novaeseelandiae*	New Zealand Bird Atlas, iNaturalist
	korimako / New Zealand Bellbird	*Anthornis melanura*	New Zealand Bird Atlas, iNaturalist
	kōtare / New Zealand kingfisher	*Todiramphus sanctus vagans*	New Zealand Bird Atlas, iNaturalist
	pīpīwharauroa / shining cuckoo	*Chrysococcyx lucidus lucidus*	iNaturalist
	makatu moana / white-faced heron	*Egretta novaehollandiae*	New Zealand Bird Atlas, iNaturalist
	Pīwakawaka, fantail	*Rhipidura fuliginosa*	iNaturalist
	pōpokatea / whitehead *Kapiti Island	*Mohoua albicilla*	New Zealand Bird Atlas, iNaturalist
	pāpango / New Zealand scaup *Lake habitat	*Aythya novaeseelandiae*	New Zealand Bird Atlas
	Grey teal *Pond habitat	*Anas gracilis*	New Zealand Bird Atlas, iNaturalist
	pūkeko	*Porphyrio melanotus melanotus*	New Zealand Bird Atlas, iNaturalist
	pīwakawaka / North Island fantail	*Rhipidura fuliginosa placabilis*	New Zealand Bird Atlas
	Welcome swallow	*Hirundo neoxena neoxena*	New Zealand Bird Atlas, iNaturalist
	North Island brown kiwi	*Apteryx mantelli*	New Zealand Bird Atlas
	Black Swan	*Cygnus atratus*	New Zealand Bird Atlas, iNaturalist
	pūtangitangi / Paradise Shelduck	*Tadorna variegata*	New Zealand Bird Atlas, iNaturalist
	riroriro / grey warbler	*Gerygone igata*	New Zealand Bird Atlas, iNaturalist
	ruru / morepork	*Ninox novaeseelandiae novaeseelandiae*	New Zealand Bird Atlas, iNaturalist
	tauhou / silvereye	*Zosterops lateralis lateralis*	New Zealand Bird Atlas, iNaturalist
	tūī	*Prosthemadera novaeseelandiae novaeseelandiae*	New Zealand Bird Atlas, iNaturalist
Non-resident Native - Migrant	Little tern *Waikanae estuary	*Sternula albifrons sinensis*	New Zealand Bird Atlas
	sharp-tailed sandpiper	*Calidris acuminata*	New Zealand Bird Atlas
	white-winged black tern	*Chlidonias leucopterus*	New Zealand Bird Atlas

	*Waikanae estuary		
Non-resident Native - Vagrant	Common tern	*Sterna hirundo longipennis*	New Zealand Bird Atlas

Appendix 4– Stream Summary Data and Fish IBI Scores

	Wharemaukū Stream Down	Wharemaukū Stream Up	Watercourse 1 Down	Watercourse 1 Up
Habitat Features	SEV 1 – Wharemaukū Downstream	SEV 2 – Wharemaukū Upstream	SEV 3 Watercourse 1 Downstream (up to 200m from confluence)	Watercourse 1 Upstream Kapiti Road to 200m from Wharemaukū
Average width (m)	3.2	2.5	2.3	0.8
Average depth (m)	0.09	0.1	0.06	0.04
Dominant substrates	Silt and small to medium gravel	Medium gravel	Sand with some silt	Silt and sand
Macrophyte abundance	Minimal, bankside Willow weed, starwort, water celery, water cress	Trace Starwort, watercelery, water cress.	Trace Starwort, batchelors buttons	Nil
Riparian vegetation	Short grass	Short grass	Pasture and grazed wetlands	Pasture and bare ground
Water Quality				
Date	25/07/2023	25/07/2023	25/07/2023	25/07/2023
Time	14:30	15:20	16:20	-
Temperature (°C)	12.5	11.9	12.9	-
Oxygen saturation (%)	105	98	48	-
Dissolved oxygen (g/m^3)	11.1	10.4	4.9	-
Conductivity (mS/cm)	180	187	218	-
Fish				
Species recorded	Inanga, redfin bully, common bully, shortfin eel	Inanga	Shortfin eel, longfin eel, common bully	-
Number of fish	9	4	6	-
Fish IBI Score & Rating	28 'Poor'	16 'Very Poor'	22 'Poor'	-
Stream Ecological Value				
SEV Score (current)	0.34	0.34	0.24	0.24

Appendix 5 – Fish IBI Scores

	Index of Biological Integrity - Wellington Region : Fish Centre for Freshwater Ecosystem Modelling and Management, Massey University						
Batch notes							
Site code or name		W Dn	W Up	Drain			
Altitude (metres)		4	4	4			
Distance from coast (km		2.1	2.4	2.1			
Scientific name	Common name						
Aldrichetta forsteri	Yelloweye mullet						
Ameiurus nebulosus	Catfish						
Anguilla australis	Shortfin eel	1		1			
Anguilla dieffenbachii	Longfin eel			1			
Carassius auratus	Goldfish						
Cheimarrichthys fosteri	Torrentfish						
Cyprinus carpio	Koi carp						
Galaxias argenteus	Giant kokopu						
Galaxias brevipinnis	Koaro						
Galaxias divergens	Dwarf Galaxias						
Galaxias fasciatus	Banded kokopu						
Galaxias maculatus	Inanga	1	1				
Galaxias postvectis	Shortjaw kokopu						
Gambusia affinis	Mosquitofish						
Geotria australis	Lamprey						
Gobiomorphus basalis	Crans bully						
Gobiomorphus breviceps	Upland bully						
Gobiomorphus cotidianus	Common bully	1		1			
Gobiomorphus gobioides	Giant bully						
Gobiomorphus hubbsi	Bluegill bully						
Gobiomorphus huttoni	Redfin bully	1					
Mugil spp.	Mullet						
Neochanna apoda	Brown mudfish						
Oncorhynchus mykiss	Rainbow trout						
Perca fluviatilis	Perch						
Retropinna retropinna	Common smelt						
Rhombosolea retiaria	Black flounder						
Salmo trutta	Brown trout						
Scardinius	Rudd						
Tinca tinca	Tench						

Index of Biological Integrity - Wellington Region : Fish

Centre for Freshwater Ecosystem Modelling and Management, Massey University

Site	IBI score	Rating
W Dn	28	Poor
W Up	16	Very Poor
Drain	22	Poor

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Appendix 6. Classification of watercourses on site again assessment criteria.

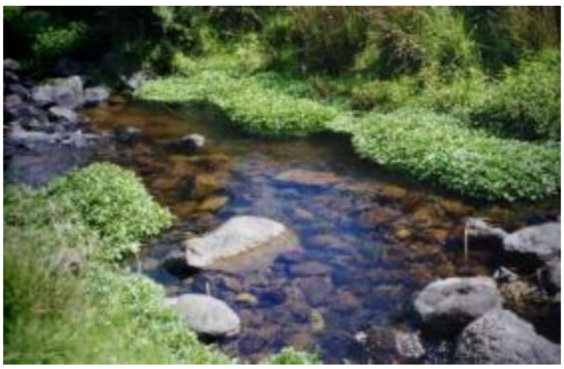
Assessment Criteria	Drain 1	Drain 2	Drain 3	Drain 4	Watercourse 1	Wharemaukū Stream
Period and mechanism of creation	Partially prior to 1998, remainder prior to 2005. Artificially cut drainage network	Constructed around 2018.	Partially prior to 1998, remainder prior to 2005. Artificially cut drainage network	Prior to 2005. Artificially cut drainage network	Prior to 1951, channel alignment unnatural straight, indicating purposeful construction through mechanical excavation.	Prior to 1951, natural stream which has been modified
Pre-existing watercourses presence	No, prior to construction, drain footprint situated over managed pasture with no flow paths present to indicate historic presence of watercourse				No, watercourse alignment unnatural, flowing east to west and against flow of surrounding natural catchment (south-east to northwest) with upstream extent outside of the site following similar, unnatural alignment and straightened channel with unnatural bends. Upper reaches abruptly form to the east of the site with no natural headwaters or drainage patters indicating natural stream extent (Figure 7)	Yes, natural flow path modified to re-align and straightened current day stream placement. Historic aerials show connection to natural headwaters and upper reaches south of the site boundary (Figure 6)
Pre-existing wetland presence	No, prior to construction, drain footprint situated over managed pasture, with no wetland extent present	No, pasture and scrub vegetation present in historic aerial images, drain footprint situated over pasture and scrub.	No, prior to construction, drain footprint situated over managed pasture, with no wetland extent present.		Indeterminant, historic vegetation type consisted of WF8 forest. The majority of the drain length is located 35 m – 120m south-east of the dune system, with approximately 120 m of drain artificially cut into the dune. The entirety of this watercourse's extent shows similar surrounding land characteristics (Figure 7).	No, historic, modified stream extent flows through managed pasture with no wetland features present.
Source of flow	Artificial drainage, some sub-soil drainage				Artificial drainage and groundwater	Upstream catchment

Physical morphology	Drains into Watercourse 1, in which the banks are highly incised, steep and deep along a straightened flow path, with channel mechanically excavated.	Contains no connection to the wider catchment, or drainage network with consistent bank width and water depth throughout with channel mechanically excavated	Multiple smaller drainage networks with slow to no flow. Bank width variable. Channel formation within landscape unnatural with channel mechanically excavated		Retains no connectivity to its up/low reach after 1973. Headwaters abruptly begin on eastern side of the site. Channel entirely straightened with steep (average 2 - 3 m high) embankments with consistent bank width, with some reduction in width where the drain bisects the dune landform. Water depth consistent throughout the channel	Variable channel width and water depth with gravel and silt substrate. Banks sloping or near flat with gravel beds. Water depth variable throughout channel with runs and small riffle sections.
Flow / Water permanence	Permanent water, although usually stagnant	Intermittent presence of water	Intermittent presence of water	Intermittent presence of water	Potentially permanent water, evidence of stagnant conditions.	Permanent flow
Ecological description and values	Drain 1 is a linear, uniform constructed drain. The substrate was sand and silty sand. The drain formed a uniform run, with no flow during the site visits when the drain was assessed or checked. The water quality was very poor with a drum biofilm, bacterial sheen on the water surface. The riparian vegetation was comprised of a narrow band of	Drain 2 was a set of very shallow drains in the northern part of the site associated with wetland habitats and they are included within the wetland complex. Refer to Seciton 5.5.3.3 and 5.5.4.8. The aquatic ecological value of Drain 2 was assessed to be of **negligible** ecological value.	Drain 3 and 4 are constructed drains (refer Section 5.5.3.4). The drains contained no or very limited water, largely restricted to pooled areas when the site was saturated in May 2023 and completely dry in May 2024. The water quality was low, with patches of stagnant water during the initial site visit, and potential fauna habitat was limited to macrophytes in the silt substrate. The riparian vegetation was comprised of wetland vegetation, largely exotic weeds and exotic pasture species. The aquatic ecological value of the drains was was assessed to be of **negligible** ecological value.		Watercourse 1 is located at the base of a steep sided drain, with an average width of 1.2m. The substrate was sand, and silty sand, except the vicinity of the culverts where occasional harder substrate (rip rap was present). The drain formed a long shallow run with no hydrological variation. The riparian vegetation was depauperate, comprised of exotic pasture grasses and weeds, but because the drain was so deep, there was no connection between the riparian vegetation and the water, and no connection to the floodplain. Filamentous green algae formed mats within areas of the drain during dryer periods of the year, resulting in oxygen reducing processes. .No Galaxidae spawning habitat was present. The aquatic habitat diversity and abundance was poor, with habitat restricted to occasional macrophytes. Shading on the	Two reaches of the Wharemaukū Stream were assessed using the Stream Ecological Valuation Methodology. The SEV scores (rated from 0 – no stream habitat to 1 – pristine stream habitat) were both very low at 0.34. Considering the highly modified nature of the stream reach near the site, and the high potential for At Risk – Declining species to utilise the reaches of the stream near to the site, as well as the in-stream habitat quality and general condition, this stream assessed to be of **Moderate** ecological value. Refer Section 5.5.3.1

	gorse and then exotic pasture species. There was no connection to the riparian vegetation or floodplain. The habitat for aquatic fauna was depauperate . No fish were recorded. This drain was assessed to be of **negligible** ecological value.				drain was generally poor, with the only shading provided by the steep banks. A Stream Ecological Valuation assessment was carried out in a representative reach of in the lower half of the drain. The SEV score was 0.24, indicative of very poor quality aquatic habitat. The SEV was considered representative of the entire drain as the upper reach was similar in form and function, albeit reduced in width, water depth, and habitat provisions. (Refer **Appendix 4**.) Migratory native fish were recorded from the mid and lower drain, with a fish IBI score of 'poor'. Watercourse 1 was assessed to be **Negligible** in the upper reaches and **Low**, in the reaches closer to the Wharemaukū Stream.	
GWRC classifications	Drain	Drain	Majority of reach shown as natural river or stream. One section of highly modified stream	Lower portion shown as highly modified watercourse. Remainder drain	Highly modified stream	Highly modified stream
Bioresearches Classification	**Artificial Drain**				**Artificial Drain**	**Highly Modified Stream**

Appendix 7– Wharemaukū Stream Enhancement Toolbox

Boulders on the edge of the stream near the banks, creating eddies and pools. Positioned near the banks to allow for stream maintenance.




Shallow areas near the bank suitable for bully spawning habitat & macroinvertebrates




Root wads – provide habitat and variation in hydrology




Shallow pools form in around boulders and after stream maintenance (also refer to photos above)




Riparian planting with root mats - providing filtration and habitat

Auckland

Address | Level 4, 68 Beach Road, Auckland 1010

Post | PO Box 2027, Shortland Street, Auckland 1140, New Zealand

Ph | 64 9 379 9980

Fax | +64 9 377 1170

Email | contact-us@babbage.co.nz

Hamilton

Address | Unit 1, 85 Church Road, Pukete, Hamilton 3200

Post | PO Box 20068, Te Rapa, Hamilton 3241, New Zealand

Ph | +64 7 850 7010

Fax | +64 9 377 1170

Email | contact-us@babbage.co.nz

Christchurch

Address | 299 Durham Street North, Christchurch, 8013

Post | PO Box 2373, Christchurch 8140, New Zealand

Ph | +64 3 379 2734

Fax | +64 3 379 1642

Email | solutions@babbage.co.nz

Babbage Consultants Australia Pty Ltd – Australia

Address | Suite 4, Level 2, 1 Yarra Street, Geelong,

Victoria 3220, Australia

Ph | +61 3 8539 4805

Email | contact-us@babbage.co.nz

www.bioresearches.co.nz

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